# STUDY OF THE CHARACTERISTICS OF RICE FIELDS IN THE UNITED STATES



MISCELLANEOUS PAPER NO. 4-602

October 1963





U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

ARMY-MRC VICKSBURG, MISS.

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...r. W. G. Shockley
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MP 4-594, "Visit to University of Illinois to Discuss Tropical Soils Studies" August 1963. Statement 5 applied by M&E Div 3/5/68.

MP 4-602, "Study of the Characteristics of Rice Fields in the United States," October 1963. Statement 5 applied by M&E Div 3/5/68.

MP 4-621, "Speed Tests Conducted in Canada During Musket Trafficability Test Program, August 1962" July 1963. Statement 5 applied by M&E Div 3/5/68.

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W. G. Shockley

SHOCKLEY

Incl

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U. S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
OFFICE OF THE DIRECTOR
VICKSBURG, MISSISSIPPI

REFER TO WESSR

21 May 1963

MEMORANDUM FOR RECORD:

SUBJECT: Study of the Characteristics of Rice Fields in the United States

1. The field trips reported herein were made by Messrs. J. G. Kennedy and J. G. Collins of the Trafficability Section during the periods 25-29 March and 9-12 April 1963, to Stuttgart, Ark., Kelso, Ark., and Stoneville, Miss., during the former period and to Crowley, La., during the latter period.

## Purpose

2. The over-all purpose of this study is to determine seasonal characteristics of rice fields, pertinent to military operations, in several locations in the United States. The specific objectives of the field trips reported herein were to:

a. Collect data during the peak of the wet season in selected areas of the Mississippi Valley rice lands to (1) determine maximum moisture conditions produced by natural wetting and (2) delineate the trafficability characteristics of the soils.

b. Measure vegetation and terrain geometry of rice-field surfaces.

c. Obtain information on the cultural practices used in the U. S. rice lands.

d. Determine what information is presently available on rice lands, such as soil maps, weather records, aerial photographs, cultural practices, etc.

## Scope

3. This report is limited to visits made to the Rice Branch Experiment Station, Stuttgart, Ark., and general vicinity; Southeast Agricultural Experiment Station, Kelso, Ark.; Delta Branch Experiment Station, Stoneville, Miss.; and Rice Experiment Station, Crowley, La., and vicinity. Twenty-two test sites were located and tested for trafficability characteristics in a variety of soil types and under varying management practices. A few of these sites will be selected for occasional retesting during the crop-growing season to determine the effects of cultural practices on military activities. Seasonal changes in flooding, and vegetation and soil characteristics will be determined.

WESSR

SUBJECT: Study of the Characteristics of Rice Fields in the United States

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**Description of Experiment Stations and General Findings**

4. The general organizational structure of the experiment stations visited, brief summaries of discussions held, cultural practices employed, station tours, and a survey of existing data and publications are discussed in the following paragraphs.

Rice Branch Experiment Station,
Stuttgart, Ark.

5. The Rice Branch Experiment Station is owned and operated by the University of Arkansas, Division of Agriculture, Fayetteville, Ark. Mr. Francis J. Williams is the Assistant Director.

6. General discussions. Following a discussion of the purpose of our visit, Mr. Williams agreed to let us test in any areas of the Experiment Station we desired. He also told us that rice was being grown at the Southeast Agricultural Experiment Station at Kelso, Ark. (60 miles southeast of Stuttgart), owned and operated by the University of Arkansas, and he felt that Mr. Kenneth Smith, the Assistant Director, would be willing to cooperate with us.

7. Cultural practices. At the time of the visit much preparation by the local farmers was in progress for the spring planting. Seeding dates range from 20 April to 30 June, depending upon the variety of seed used, weather, soil conditions, and the method of seeding. Fields were being disked and leveled, and dikes were being constructed. The dikes are constructed at elevation differences of 0.1 to 0.4 ft, and they are usually high enough to hold 6 in. of water on the rice fields and broad enough to prevent the water from breaking through.

8. Two types of rice seeding are used; namely, on dry and on flooded rice beds. The latter is referred to as water seeded. When rice is seeded on dry seed beds, the fields are flooded with 1 to 2 in. of water when the rice reaches a height of 4 to 6 in., approximately four to six weeks after planting. As the plants grow taller, the water depth is gradually increased until it reaches 4 to 6 in. In areas that are water seeded, the fields are first flooded, the seeds are sown, and the water level is lowered until the plants have become well anchored in the soil and start to grow. As the height of the plants increase, the water level is increased. The flooded seed beds are planted from airplanes; and the new, uncompacted dikes surrounding these fields are higher and broader, since they are subjected to pressure and wave action before they have a chance to settle and before a crop is growing on them. In both methods of seeding, the water may be drained off periodically during the growing season as necessary to control certain water plants, plant diseases, and insects.

9. Mr. Williams stated that the fields at the Rice Branch Experiment Station will be drill seeded (sown in furrows with uniform spacing of seed).

10. The number of days from seeding to maturity ranges from 109 to 150, depending upon the variety of seed used. The water is drawn off the fields approximately 10 days prior to harvest to allow the fields to dry sufficiently to support the harvesting equipment. Crop rotation is practiced on rice lands.

11. Tour of Experiment Station grounds. A tour was made of the Experiment Station, which consists of 915 acres. Areas that would be planted in rice this spring, between 15 April and 15 May, and the fields that will be water leveled (process used in leveling land for rice cultivation) in July or August of this year were examined. Areas to be water leveled are flooded and leveled the same day. Water is not allowed to stand on a field to be leveled for more than a day because traction or stickiness problems make it difficult or impossible for operation of a tractor and a land leveler.

12. Existing data available. Rainfall records are maintained at the Experiment Station and copies may be obtained. There is also a weather station at Stuttgart, 8 miles west of the Experiment Station. Circulars and reports of cultural practices, water levels, etc., were obtained. A list of these publications is included in inclosure 1. During the return visits, additional information will be obtained as it becomes available. Soil maps of the Experiment Station were examined and copies can be made available.

Soil Conservation Service (SCS),
Stuttgart, Ark.

13. We visited the SCS office in Stuttgart to obtain information on the availability of aerial photographs and soil maps of the Rice Branch Experiment Station. We were informed that Mr. Herman Hill of the SCS office in DeWitt, Ark., could furnish us the information on aerial photographs. We were also told that extensive soil tests were made at the Rice Branch Experiment Station about four years ago, and we could probably obtain copies of the report, "Soils Correlation of the Rice Branch Experiment Station," and a copy of General Soil Map, Arkansas County, Ark., 4-R-12649, revised in October 1962, from Dr. H. C. Dean, State Soil Scientist, 5401 Federal Building, Little Rock, Ark. Mr. Dempsie Binkley, to whom we talked, informed us that we could expect to find three soil series at the Rice Branch Experiment Station as follows:

a. Stuttgart silt loam - moderately well drained to well drained.

b. Crowley silt loam - somewhat poorly drained.

c. Midland silt loam (This is in the process of being changed to Wrightsville.) - poorly drained.

14. Mr. Binkley accompanied us to the Rice Branch Experiment Station and made auger borings in several different locations in the Stuttgart, Crowley, and Midland silt loam and showed us how we could distinguish each series.

15. We asked Mr. Binkley if he could give us names of any farmers in the vicinity who had rice lands in representative clay areas and who might be willing for us to test on their property. He told me to contact Mr. Robert J. Bormann of Stuttgart, who has a farm located on Meto Bayou in the Perry clay soil series.

Bormann Farm, Stuttgart, Ark.

16. We contacted Mr. Robert J. Bormann, Route 2, Stuttgart, Ark., (telephone No. WA3-4140) to get permission to test clay areas on his farm. After we explained the nature of our tests, he said it would be all right for us to test any place we selected. He showed us the area that will be planted this spring. These fields will be water seeded. There is a gate across a private road leading to these fields. He said if we revisited these areas and the gate was locked, he would have the key, and Mr. Charles Haskyn, who lives 0.4 miles west (the next house on the left from his), also would have a key. He also told us that Mr. Fred Hardy of Oak Grove, La. (50 miles from Vicksburg), has about 500 acres of rice land in a fat clay area.

Southeast Agricultural Experiment
Station, Kelso, Ark.

17. We next visited the Southeast Agricultural Experiment Station of the University of Arkansas at Kelso, Ark. (mailing address is Rohwer, Ark.), where we talked with Mr. Kenneth Smith, the Assistant Director, and obtained his permission to locate test sites in areas that will be planted in rice this spring. Mr. Smith told us that the Experiment Station consists of 650 acres, and approximately 200 acres will be planted in rice this spring. He showed us these areas. He said that the SCS people had reclassified the soil about three times and he was not certain what it is being called, but he thought it is a Buxton clay. On the next visit to this area, Mr. Hugh Hill of the SCS, whose office is located at 210 2nd Street, McGehee, Ark. (telephone No. CAnal 2-4471), will be contacted for a definite classification of these soils. Mr. Smith said there would be no water leveling this year.

Delta Branch Experiment Station,
Stoneville, Miss.

18. A visit was also made to the Delta Branch Experiment Station, Stoneville, Miss., where we contacted Dr. Walter K. Porter, Jr., Superintendent. Dr. Porter said that there will be only 25 acres of rice planted at the

Experiment Station this year. He suggested that we talk with Dr. Donald H. Bowman, whose office is in the same building, since he is in charge of rice research. Dr. Bowman informed us that our best contact in Mississippi regarding rice cultivation was Mr. Harrold Lyons, President of the Mississippi Rice Council, American Legion Building, Cleveland, Miss. Dr. Porter said that it would be all right with him for us to establish test sites in the rice fields at the Delta Station, which are in a Sharkey clay. These fields will be planted in the early part of May.

Fuselier Farm, Mamou, La.

19. While en route to Crowley, La., we observed what we assumed was a water-leveling operation, so we stopped to observe and photograph it (see inclosure 2). We learned later that this was not water leveling but a process of muddying the field prior to water seeding (see paragraph 23). The field was flooded with approximately 6 in. of water, and the tractor with drag attached had no difficulty maintaining a speed of approximately 5-10 mph. The owner of the farm is Mr. Flores Fuselier, whose address is Route 2, Box 193, Mamou, La. After explaining the general nature of our tests, we asked for and obtained his permission to test the field that was being muddied. We told him we may want to retest during various periods of the growing season; he said that would be all right with him.

20. Mr. Fuselier informed us this was the first year that he had tried this process and so far there had been no difficulty operating the equipment in the flooded fields. He seemed very enthusiastic about the results. He said the field we saw being muddied had had water on it for the last three days. This field and the adjoining ones would be water seeded (with pre-sprouted seed) in the next day or two after our visit.

Rice Experiment Station,
Crowley, La.

21. The Rice Experiment Station, Crowley, La., is owned and operated by Louisiana State University, Baton Rouge, La. Dr. H. R. Caffey is the Superintendent.

22. General discussions. We discussed with Dr. Caffey the purpose of our visit and the type of tests we planned to conduct at the Rice Experiment Station and in the vicinity. There will be approximately 150 acres planted in rice, for general production or seed rice, with other areas divided into small plots to test fertilizer control, various seed types, etc. We told Dr. Caffey we would not locate any of our test sites in these experimental rice plots since they would be under intensive observation. He said it would be all right to locate our sites in any areas in the large rice fields.

23. We told him of observing what we had thought was the water-leveling operation at the Fuselier farm. He said this was not true water leveling, but a process known as muddying the field prior to water seeding. This operation puts the soil in suspension in the water; and, when the seed are sown by airplane, the soil settles on the seed, thus holding them in place in the seed bed. This process levels the land to some extent by pulling down high spots in the field, but large amounts of soil are not moved as in true water leveling and the over-all elevation of the field is not changed. We also observed this muddying operation in a field adjoining the southeast boundary of the Experiment Station. This field is owned by Mr. Louis Leonards, Crowley, La. Dr. Caffey obtained permission from Mr. Leonards for us to locate a site in this field.

24. Two fields at the Experiment Station will be water leveled some time in July or August of this year. Dr. Caffey will notify us of the exact date. A paper, "Leveling Rice Land in Water," by M. D. Faulkner and R. J. Miears, members of the staff at the Rice Experiment Station, is included as inclosure 3.

25. Dr. Caffey informed us that tests similar to our drawbar-pull tests were conducted with various sizes of tractors and equipment in the Sharkey clay rice fields in the Mississippi Delta while he was on the staff of the Delta Experiment Station at Stoneville, Miss. Information on copies of reports of these tests may be obtained from Mr. Floyd Fulghan, Agricultural Engineer, Delta Branch Experiment Station, Stoneville, Miss.

26. We obtained names and addresses of Superintendents of Rice Experiment Stations in Texas and California, as follows:

Dr. L. E. Crane, Superintendent
Rice Pasture Experiment Station
Beaumont (China), Texas

Mr. K. E. Mueller, Superintendent
Rice Fields Experiment Station
Biggs, California

27. <u>Cultural practices.</u> Planting dates in this area range from the middle of March through June, depending on the variety of seed used and the method of seeding. Practically all phases of early rice production was in operation in the Crowley area. Some fields were at full flood with plants 9-10 in. tall (probably water seeded several weeks earlier). Other fields were wet from having the water recently drawn off, which would indicate that they had been water seeded. If the fields are water seeded with dry seed, the water (4-5 in. deep) is allowed to remain on the field until the plant is above the surface of the water. If presprouted seed are used in water seeding, the water is drawn off the field immediately after seeding. Other fields were being

disked and leveled prior to seeding on a dry seed bed. As in the Stuttgart, Ark., area, most fields that will be seeded on a dry seed bed will not have the dikes constructed until the land has first been disked and leveled. The fields will then be surveyed, marked off, and the dikes constructed to medium height. In this area, dikes are usually constructed at 0.2-ft vertical intervals. The dikes are not constructed to full height at first since damage to the farm equipment crossing dikes 12-14 in. high during the seeding operation could result. Construction of the medium-height dikes at this time also permits them to be seeded, which will help hold them in place as the plants grow and the field is at full flood (4-6 in. of water). Small drains are placed at the inside face of the dikes to control drainage of rain water prior to irrigation, and to aid in the periodic drainage of the irrigated fields. After seeding, the dikes will be brought to full height.

28. About 33 in. of water are required to produce a rice crop; of this amount, 20-24 in. are obtained through irrigation. There are several Canal Companies that supply water to the farmers at one-fifth the price they receive for the crop. The Rice Experiment Station pumps its own water from Bayou Wikoff north of the Experiment Station and from 300-ft-deep wells located on the Experiment Station grounds. Last year Bayou Wikoff became contaminated with salt (from oil wells north of Crowley) and the Experiment Station has become very careful about the use of this water.

29. As in the Stuttgart, Ark., area, the fields are drained periodically to allow for fertilization, weed and insect control, etc.

30. The fields are usually either rotated every three years with small grain crops, white clover, or pasture crops, or they are allowed to lie fallow.

31. With the exception of the field west of Crowley, which will be water seeded, all fields at the Rice Experiment Station will be drill seeded (sown in furrows 1-2 in. deep with uniform spacing of seed) on a dry seed bed.

32. Tour of Experiment Station grounds. Mr. Elvis Faulk, the field foreman, took us on a tour of the Experiment Station, which consists of 800 acres. The two fields that will be water leveled this summer, the fields that will be planted in rice around 17-18 April for general production, and the experimental rice plots were examined. Mr. Faulk said that water leveling rice fields was his idea and was started about 1951.

33. Dr. Caffey drove us to the field west of Crowley and showed us the field that would be water seeded some time during the week of 15-19 April.

34. Existing data available. Daily rainfall and maximum or minimum temperature records are maintained at the Experiment Station and copies may

be obtained. There is also a weather station at Crowley, 3 miles southwest of the Experiment Station. Circulars of cultural practice of rice farming, copies of the "Soil Survey, Acadia Parish, Louisiana" (issued September 1962), and a copy of a Soil Survey map of the Rice Experiment Station were obtained. The base for the soil maps are aerial photographs. A list of publications obtained at the Experiment Station is included in inclosure 1.

Visits to Soil Conservation Service (SCS)

35. Crowley, La. A visit was made to the SCS office in Crowley (Room 304, Courthouse, phone No. 783-5823) to obtain information on the availability of aerial photographs and to have someone from the SCS office make a definite soil series classification of our test sites. Mr. James Winston, to whom we talked, informed us that Mr. Henry Clark, the Area Soil Scientist (office in the Courthouse, phone No. 783-1257), would be the one to contact for the soil classification, but he was out of town and would not return until Friday, 12 April. He also told us that we could use the soils map of the Experiment Station with an 85-percent degree of accuracy in establishing the soil series. Mr. Winston said that we could obtain the latest aerial photographs of the area through regular channels. We asked him about the soils south of Mamou, La., in order to classify the soil on the Fuselier farm. He did not have this information; however, he said we could obtain it from the SCS office in Ville Platte, Evangeline Parish, La. I tried to contact Mr. Clark on Friday morning before I left Crowley, with no success. Dr. Caffey said that all state offices in that vicinity were closed because it was Good Friday. Mr. Clark will be contacted on the next visit for a definite classification of the soils at the Rice Experiment Station.

36. Ville Platte, La. We also visited the SCS office at Ville Platte and talked with Mr. R. J. Deous. When we asked him for soils data on the Fuselier farm, he located the farm on an aerial photograph with soil series classifications marked on it and identified the soil as a Crowley silt loam. He informed us that a soil survey of Evangeline Parish was in progress. The Fuselier farm had recently been mapped and the soil series in the area of our test site would remain the same. We asked for extra aerial photographs or soil maps of the region, but none were available. Aerial photographs can be obtained through regular channels.

## Location and Description of Test Sites

37. Twenty-two sites were located and tested at the Rice Branch Experiment Station, Stuttgart, Ark., and in the vinicity; the Southeast Agricultural Experiment Station, Kelso, Ark.; and the Rice Experiment Station, Crowley, La., and in the vicinity. These sites were located in areas that will provide a wide range of cultural practices and soil types. Maps showing the locations of the sites are presented in inclosure 4, and photographs are shown in inclosure 5. The general locations and descriptions of these sites follow.

Rice Branch Experiment Station,
Stuttgart, Ark.

38. Site 1. This site is located in a level field of approximately 30 acres that will be planted in rice this spring (fallow last year). The field is covered with grass 2-3 in. high. The soil is a Crowley silt loam.

39. Site 2. The location of this site is in a level field of approximately 30 acres that will be water leveled this summer. The field is covered with experimental winter oats 4-6 in. high. After it is water leveled, this field will lie fallow. The soil is a Stuttgart silt loam.

40. Site 3. This site is located in a 100-acre field that was water leveled last year and will be planted in soybeans this year. The field is bare. The soil series is Crowley silt loam.

41. Site 4. This site is located in the south end of the same field as site 2. The soil is a Crowley silt loam.

42. Site 5. Located in a field that will be planted in experimental rice, this site is bare. The soil is a Midland silt loam.

43. Site 6. Site 6 is located in the south end of the same field as site 1. The soil is a Crowley silt loam.

44. Site 7. This site is located in a 100-acre field, 1 mile east of the Experiment Station, and is owned by Mr. Tarkington and leased by the Experiment Station. The field will be planted in rice this spring, and had been disked and leveled one day prior to our testing and was bare of vegetation. The soil is a Crowley silt loam.

45. Site 8. Site 8 is located in the same field as site 7, 0.1 mile south. The soil is a Midland silt loam.

Bormann Farm, Stuttgart, Ark.

46. Site 9. This site is located in a 40-acre field and was sparsely vegetated with weeds 2-3 in. high. The soil is a Perry clay.

47. Site 10. Located in a 40-acre field 0.1 mile east of site 9, this site was sparsely vegetated with weeds 2-3 in. high. The soil is a Perry clay.

Southeast Agricultural Experiment
Station, Kelso, Ark.

48. Site 11. This site is located in one of approximately 25 experimental rice plots, each 100 ft square, with dikes approximately 4 ft high around each experimental plot. The plot was bare of vegetation. The tentative soil series classification is Buxton clay (will be confirmed later). This plot was plowed immediately after testing.

49. Site 12. Located in a bare, 100-acre field that will be planted in rice this spring, this site has been classified tentatively as Buxton clay.

Fuselier Farm, Mamou, La.

50. Site 13. Site 13 is located in a level field of approximately 40 acres on Louisiana Highway No. 13, 1-1/2 miles south of Mamou, La., which was covered with water 2-6 in. deep. The test site was covered with 2 in. of water; the top 3 in. of soil was a soft mud. The field was to be water seeded within the next day or two with presprouted seed and drained immediately after seeding. The soil is a Crowley silt loam.

Rice Experiment Station, Crowley, La.

51. Site 14. Site 14 is located in a level, volunteer rice field of approximately 2.5 acres. This is the third consecutive year that rice has grown on this field. The field was covered with 4-6 in. of water. The rice plants were approximately 9 in. tall. The soil is a Midland silt loam.

52. Site 15. This site is located in the southwest corner of a level, 30-acre field which had recently been plowed, disked, and leveled, and was bare of vegetation. The field will be planted in rice this spring. No dikes had been constructed. The soil is a Midland silt loam.

53. Site 16. Site 16 is located in the northeast corner of the same field as site 15. The soil is a Crowley silt loam.

54. Site 17. Site 17 is located in the field west of Crowley which is 30 acres in size and had recently been disked and was bare of vegetation. The field will be planted in rice this spring (water seeded). No dikes have been constructed. The soil is a Crowley-Midland silt loam.

55. Site 18. This site is located in the southeast corner of a level, 33-acre field that had recently been disked and leveled and was bare of vegetation. The field will be planted in rice this spring. The soil is a Crowley silt loam.

56. Site 19. Site 19 is located in the southeast corner of a level, 40-acre field that had rye grass 12 in. high growing on it and was being used as a pasture for cattle. This field will be water leveled this summer and will lie fallow. Dikes will be constructed prior to water leveling. The soil is a Crowley silt loam. This field is outlined in red in inclosure 4, fig. 4.

57. Site 20. Located in the northwest corner of the same field as site 19, the soil at this site is a Crowley silt loam.

58. Site 22. Site 22 is located in the northwest corner of a 14-acre field, the northern half of which will be water leveled this summer (outlined in red in inclosure 4, fig. 4). The field had been plowed and was bare of vegetation. Dikes will be constructed prior to water leveling. The soil is a Crowley silt loam.

Leonards Farm, Crowley, La.

59. Site 21. This site is located approximately 750 ft south of the southeast boundary of the Rice Experiment Station in a 90-acre field owned by Mr. Louis Leonards. Flooding of the field was started on 2 April, but full flood was not reached until 5 April because of the dry condition of the soil. Water had been on the field 10 days at the time of testing (11 April). The field had been muddied on 10 April and was to be water seeded on 12 or 13 April. The soil is a Crowley silt loam.

## Data Collection and Procedures

60. At each site, a sampling area was selected that appeared uniform and representative of the field. The following data and samples were collected; data results are tabulated in inclosure 6. Supplemental soil data, copied from the "Soil Survey, Acadia Parish, Louisiana," are also inclosed (inclosure 7).

### Soil data

61. Cone index. At each site, 10 sets of cone index measurements were made in an area of approximately 10 by 20 ft, with a set of cone index measurements consisting of readings made at the surface and at 3-in. vertical increments to 18 in., and then at 6-in. increments to a depth of 30 in. The silt loam soils (dry fields) were firm, and penetrations were made with the 0.2-sq-in. cone to a depth of 18 in.

62. Remolding index. At sites where samples could be obtained, remolding index was determined for the 0- to 6-in. and 6- to 12-in. depths at two locations within the test plot.

63. Soil moisture content and density. Two samples for determination of moisture content and density were taken from the 0- to 3-in., 3- to 6-in., 6- to 9-in., and 9- to 12-in. layers, provided the trafficability sampler could be used to obtain samples. If the soil was too firm to use the trafficability sampler, a soil auger or pick and shove were used to obtain samples at the same depths.

64. Bulk soil samples. Approximately 3 lb of soil was obtained from the 0- to 6-in. and 6- to 12-in. layers at three locations within each test site

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for laboratory determinations of grain-size distribution, Atterberg limits, and specific gravity.

Terrain geometry data

65. Cross sections were made of four representative sites for a distance of 100 ft on two sides of the test plot at horizontal intervals of from 1 to 10 ft (see inclosure 8). The cross sections include the rice field, field dikes, adjacent ditches, roads, etc. Additional cross sections will be made during subsequent visits to determine spacings and heights of dikes at sites where dikes were not constructed at the time of this visit.

Vegetation data

66. Records were made of the height and general type of vegetation at each location. Structural diagrams are presented in inclosure 9.

Hydrologic geometry data

67. The general depth of water in the flooded rice fields was measured and recorded. Cross sections of irrigation canals and reservoirs, water depth, etc., in the vicinity of the sites will be made during subsequent visits.

Photographs

68. Photographs of each site were taken as shown in inclosure 5.

## Discussion of Data

Soil strength-moisture data

69. Dry silt loam areas. In the dry silt loam areas tested at the Rice Branch Experiment Station, Stuttgart, Ark., and the Rice Experiment Station, Crowley, La., and in the vicinities thereof, the cone indexes of the 0- to 6-in. soil layer ranged from 125 to 750+, and of the 6- to 12-in. layer from 177 to 750+. The 750+ readings for both layers were obtained from a field being used as a pasture for cattle and having rye grass 12 in. high growing on it. Because of the loose (caused by recent disking or plowing) dry soil in the 0- to 6-in. layer, remolding samples could be obtained only from this depth at two sites (2 and 3). Rating cone indexes ranged from 161 to 285 for the 0- to 6-in. layer; and, at sites where remolding samples could be obtained, the rating cone indexes of the 6- to 12-in. layer ranged from 115 to 491. The soil moisture content ranged from 8.2 to 24.2 and from 12.6 to 31.2 (percent by weight) for the 0- to 6-in. and 6- to 12-in. layers, respectively.

At the time of testing, these rice fields could be negotiated easily by military vehicles with little rutting and at speeds up to about 15 to 25 mph.

70. Flooded silt loam areas. Three of the sites tested (13, 14, and 21) were flooded with water ranging from 2 to 6 in. deep. The cone indexes of the 0- to 6-in. soil layer ranged from 61 to 95. Because the soil in the 0- to 6-in. layer, at site 13, had recently been disturbed (within 20 minutes prior to sampling) by a tractor and drag during the muddying operation, remolding samples were obtained at only two sites at this depth (14 and 21). Rating cone indexes ranged from 29 to 30 for the 0- to 6-in. layer and from 95 to 98 for the 6- to 12-in. layer. The soil moisture content ranged from 24.6 to 27.2 and 21.7 and 28.6 (percent by weight) for the 0- to 6-in. and 6- to 12-in. layers, respectively. The soil strength in the flooded areas was adequate for most military vehicles; however, repetitive traffic in excess of 50 passes would have caused severe rutting and perhaps occasional immobilizations. The soft surface soil layer, however, might have caused first-pass immobilization because of slipperiness.

71. Clay areas. The cone indexes of the clay areas at the Bormann farm, Stuttgart, Ark., and at the Southeast Agricultural Experiment Station, Kelso, Ark., ranged from 44 to 114 and from 57 to 147 for the 0- to 6-in. and 6- to 12-in. soil layers, respectively. The rating cone indexes ranged from 39 to 77 for the 0- to 6-in. and from 58 to 135 for the 6- to 12-in. layers. Moisture content (percent by weight) ranged from 28.4 to 49.8 and from 28.2 to 49.6 for the 0- to 6-in. and 6- to 12-in. layers, respectively. Site 12, located at the Southeast Agricultural Experiment Station, had less moisture content and greater strength than other sites in the clay areas (see inclosure 6). This was the only site in the clay areas that did not have dikes or levees around it; thus better surface drainage would have occurred. Also, this was the only site in the clay areas that had recently been plowed. The soil strength in the clay areas was adequate for most military vehicles; however, repetitive traffic in excess of 50 passes would have caused severe rutting and perhaps occasional immobilizations. After about 10-20 passes in the same ruts, speed would be reduced to less than 5 mph.

### Terrain geometry

72. All sites were located on level terrain. In the silt loam areas, dikes had been constructed in only three fields where sites were located (13, 14, and 21). Inclosure 5, fig. 23, is a photograph of typical dikes on the Fuselier farm in the silt loam area. Dikes similar to these were also found on the Leonards farm. Site 14 had straight dikes around the outside perimeter of the 2.5-acre field. Sites 9 and 10 on the Bormann farm were located in the fields with dikes constructed probably several months prior to the date of testing. The size and shapes of typical dikes are given in inclosure 8, fig. 4. There would be no problem for most military vehicles in negotiating the field dikes at a speed of about 5 mph.

At the time of testing, these rice fields could be negotiated easily by military vehicles with little rutting and at speeds up to about 15 to 25 mph.

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Vegetation

73. Thirteen sites were bare (3, 5, 7, 8, 11, 12, 13, 15, 16, 17, 18, 21, and 22); sites 1 and 6 were covered with Bermuda grass, clover, and other miscellaneous weedy vegetation 2-3 in. high, with about 20 percent bare soil; sites 2 and 4 had mats 4-6 in. high growing on them; sites 9 and 10 were sparsel vegetated; site 14 had rice plants 9 in. tall growing on it; sites 19 and 20 had rye grass 12 in. high on them. During the time of testing, vegetation would not have affected vehicle operations.

Hydrologic geometry

74. Irrigation canals 10 to 15 ft wide and from 3 to 5 ft deep were in the general vicinity of all sites. Inclosure 10 is a photograph showing water being pumped from a 300-ft-deep weel into a typical irrigation canal at the Rice Experiment Station, Crowley, La. The well is located approximately 200 ft northeast of site 16 (identified as 1W in inclosure 4, fig. 4). The canal runs west from the pump across the Experiment Station. There are roads crossing the canal at various points. The canals would result in "no-go" conditions for military vehicles unless they were bridged.

75. As indicated in paragraph 70, fields in which three test sites (13, 14, and 21) were located had been flooded with 2-6 in. of irrigation water (see inclosure 5, figs. 13, 14, 21, and 23).

## Preliminary Analysis

76. Based on the rating cone index of the 6- to 12-in. soil layer at the sites tested in the dry silt loam areas, conventional military vehicles would have no difficulty making 50 passes across any of the areas. All flooded silt loam areas and clay areas would support 50 passes of conventional military vehicles except site 11, which was located in a clay area on the Southeast Agricultural Experiment Station at Kelso, Ark., (rating cone index of 58) and would probably allow 50 passes of a vehicle with a vehicle cone index of 60.

77. Vegetation would offer no problem to the movement of military vehicles.

78. With the exception of irrigation canals in the general vicinity of all sites, terrain would not hinder the movement of vehicles.

## Suggestions for Future Visits

79. It is suggested that selected sites be retested on the following schedule:

a. One to two days after the first flooding, which will be approximately during the second week of May.

b. Several visits during the rice-growing season to determine the effects of flooding on soil consistency and changes in vegetation characteristics.

c. During the water-leveling operation in July or August.

d. Two to three days prior to harvest, which is normally during the last part of August or the first part of September.

James G. Kennedy

10 Incl
es

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Trafficability Section

Copy furnished:
Mr. Grabau

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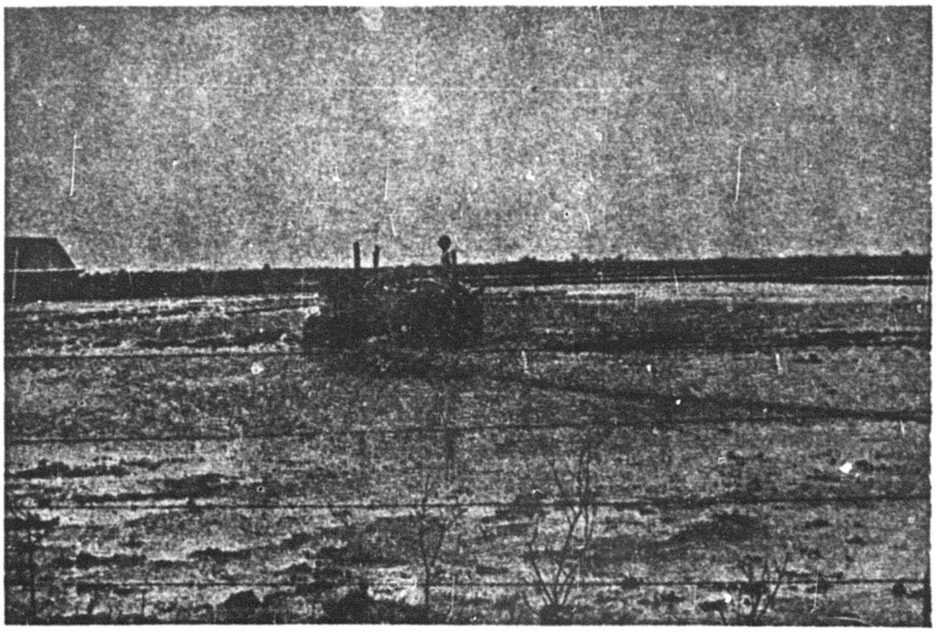


Muddying operation prior to water seeding
Fuselier Farm, Mamou, La.

# LEVELING RICE LAND IN WATER

M. D. Faulkner and R. J. Miears

## INTRODUCTION:

Many factors have a direct influence on the yield of rice produced on any given field or farm. It has been recognized for many years that rice field weed control is often dependent upon the proper depth of flood water. Also it is recognized that deep flooding can cause some damage to the rice plant. Therefore, the uniformity of flood water on rice is very important. In southwest Louisiana, most of the rice field levees are spaced at 0.2' vertical intervals. This results in a normal flood range of 4.0 to 6.4 inches in depth. Not only is there a possibility that damage to rice will result from greater depth of water, but if greater volumes of water are required, then pumping cost will increase. On improperly leveled fields, a greater number of levees are required to obtain proper flooding conditions. Since the yields of rice are greatly reduced on levees, this will result in an overall field yield reduction. Levees are also a source of grass seed infestation for the rest of the field. A greater number of levees will require more labor for flushing and for flooding operations. Since the crossing of levees is damaging to farm equipment, maintenance expenses will be greater.

Dry land leveling has been a farm practice for many years. Regardless of the type of farm leveling machinery normally used, this does not change the general topography of the soil, but corrects comparatively small local depressions and hills. It is extremely difficult to move large amounts of soil by this method. However, this practice is responsible for increased rice yields because it aids in improved flooding conditions.

Because of the artificial hard plow sole pan and the true hard pan found in most rice soils, it is possible to operate equipment in flooded fields with ease. It was felt that a more complete and faster leveling of the soil could

be accomplished in the water than on dry soil. By utilizing the water as a moving agent, greater amounts of soil can be moved and at faster rates than under dry conditions. By this method, the number of levees can be greatly reduced or on small fields completely eliminated.

The authors of this paper are reporting on leveling in water of rice soils at the L.S.U. Rice Experiment Station, Crowley, Louisiana. This method of soil leveling has created interest among rice farmers of the area.

RESULTS AND DISCUSSION:

From the preliminary or initial survey of the field, the extremes in elevation is from 97.75' to 96.94' or a difference of 0.81'. This is probably as much difference in elevation that could be changed by land leveling in water. This difference in elevation would mean that 0.81' or 9.71" of water would be necessary in the low portions of the field to barely cover the high portion of the field. Difficulty in machine operation is experienced in deeper water, as well as difficulty in determining where to work in regard to the low portions of the field.

The preliminary survey also shows over 4000 feet of levees existed before leveling began. Since normally levees are 10' in width this would mean that approximately one acre or over 9% of the field was devoted to levees. In eliminating the levees, not only can an increase in yields be expected but a much easier and economical farming operation can be enjoyed. The removal of levees will create the following benefits in rice farming.

1. Less levee making
2. Less levee maintenance
3. Easier flooding and draining
4. Easier cultivation
5. Less chance of levee washing

6. Higher yields

7. Easier combining of the rice

8. Facilitate irrigation of crops grown on the land other than rice

9. Less grass infestation from levees

From the measurement of water depth during the leveling operation in the water, it was noted that a difference of 0.4' in elevation still existed. On the basis of this observation work was continued in the water as long as the soil would move freely. One very important part of this type of land leveling is to be able to do all the necessary work in water in one day, if possible. After remaining under water over night and not having been worked the soil becomes compacted and very difficult to move.

After draining the water from the field, a difference of 0.4' in elevation still existed but on a very localized basis. All variations in elevation were changed to within 0.2' by using the model 329 Eversman land leveler and tractor.

The final relative elevations existing in the field after all leveling had been completed are within 0.2' which is considered accurate enough for rice irrigation.

Although the general slope of the field is toward the south after all leveling is complete, a true grade line need not be followed for successful rice irrigation. As noted previously the allowable variation in elevation is 0.2' for rice irrigation. This small difference in elevation will normally cause no trouble in draining, since drains are plowed in the fields after planting and prior to irrigating. These drains will usually carry all rain water before the first irrigation and drain the field when the irrigation water is removed.

Results of the chemical analysis of the soil are shown in Table 1. There was greater differences between samples than between times of sampling.

Therefore the soil leveling operation apparently had no effect on the availability of plant nutrients as measured by the analysis.

The sample taken prior to the land leveling in Quadrant III showed high available phosphorus. This area had high phosphorus applications on clover two years prior to this operation. In the land leveling operation, this soil was spread to other parts of the area.

As shown in Table 2, only a very slight change in the texture of the soil occurs during the leveling operation. A slight decrease in clay content occurs and an increase in silt. Some change in sand content is noted, but is not significant to make any definite trend.

No great change can be noted in the plow sole pan as far as depth is concerned. However, in the portions of the field that were highest or lowest, increases were noted, in that the places that were originally low the plow sole pan was as deep as 12" while on the original highs the plow sole pan was as shallow as 4". These differences in plow sole depth were only in small areas, and are felt to be of no great importance in regard to the overall characteristics of the field. The slight change in plow sole pan depth is due partially to the state of the top soil during leveling operation. During the work in the water the top soil is in an almost fluid state and moves away from the leveler blade, while the plow sole pan is fairly compact and can be moved while under water.

Normally great accuracy is not as necessary as indicated by this experiment in surveying the land. Even though levees are usually located at 0.2' vertical intervals, there will almost always exist between any two levees a variation greater than 0.2'. Therefore, from a standpoint of time requirements for this experiment, only the actual leveling and land preparation prior to leveling is considered. The total time required to work in the water was

18 hours and 20 minutes, 15 hours and 30 minutes after drying, and 14 hours to prepare the land.

This was a total time of 47 hours and 50 minutes or 4 hours and 21 minutes per acre. The time is based on use of tractor and one man.

Using average cuts and fills at the four corners of the 50' x 50' grids to calculate earth moved, a total of 768 cubic yards of earth was moved, or 69.8 cubic yards per acre.

From experience, at the Rice Station, machinery can be expected to depreciate faster in water than on dry land operations. The most trouble developed in wheel bearings, tractor rear axel bearings, and transmission. Mud and water began to enter the transmission housing through the axel housing as the axel bearings began to go bad. No comparative analysis has been made as far as depreciation between dry leveling and leveling in water.

To assure the most efficient operation of equipment, the operators should be made completely familiar with the land to be leveled in water. This may be accomplished by a survey or through experience the operator may have gained from irrigating the land.

One very attractive aspect of this type of land leveling, as far as rice farmers are concerned, is that they will either own or have access to the necessary equipment to successfully complete the operation. Normally the only equipment necessary is a tractor, leveler and equipment to prepare a seedbed.

The tractor to be used in the water should be a 50 H.P. tractor or greater since fast movement is necessary for good wave action and consequent smoothing of the soil. The movement of soil is dependent on wave action to a large extent both for moving the soil and spreading, since a wave will tend to carry soil until it reaches a low point or an area with increased cross section, as far as water depth. When the water and soil reach this increased cross

sectional area, a reduction in velocity occurs and the soil will deposit from the water.

In fields too large or with an elevation differential to great to level, to completely eliminate all levees, the practice of land leveling in water can be used to eliminate every second levee and to straighten the remaining levees. This practice is accomplished by making levees on 0.4' contours and leveling in water between these levees. Since the desired elevation difference is 0.2', only 0.1' of soil has to be moved from the high portion to the low portion of the area inclosed by the levees run on 0.4' vertical intervals. This practice creates the problem of having a 0.2' elevation differential across levees, which will increase the possibility of washing the levee and consequent crop damage due to rains and deep irrigation water.

The possibility of levee washing can be partially eliminated by using permanent levees, built higher than necessary for natural 0.2' levees.

Table 1. The chemical analysis of rice soil prior to and following leveling in water.

| Available Element | Prior to Leveling: Quad. I | Quad. II | Quad. III | Quad. IV | Avg. | Following Leveling: Quad. I | Quad. II | Quad. III | Quad. IV | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| P, p.p.m. | 17 | 21 | 63* | 14 | 17 | 19 | 21 | 19 | 20 | 20 |
| K, p.p.m. | 26 | 48 | 48 | 26 | 37 | 35 | 35 | 35 | 26 | 33 |
| Ca, p.p.m. | 1123 | 950 | 778 | 994 | 961 | 1080 | 950 | 907 | 907 | 961 |
| Mg, p.p.m. | 231 | 277 | 203 | 221 | 233 | 251 | 263 | 251 | 238 | 251 |
| Ph | 5.7 | 5.4 | 5.1 | 5.6 | 5.5 | 5.8 | 5.9 | 5.9 | 5.9 | 5.9 |

* This quadrant had high applications of phosphorus applied to clover in previous years. Not included in average.

Table 2. Mechanical soil analysis before and after leveling.

| Sample | Before Leveling: % Sand | % Clay | % Silt | Textural Class | After Leveling: % Sand | % Clay | % Silt | Textural Class |
|---|---|---|---|---|---|---|---|---|
| Quad. I | 7.6 | 27.1 | 65.3 | Silt loam | 7.6 | 21.4 | 71.0 | Silty clay loam |
| Quad. II | 6.8 | 24.7 | 68.5 | Silt loam | 7.6 | 19.4 | 73.0 | Silt loam |
| Quad. III | 8.9 | 21.6 | 69.5 | Silt loam | 7.6 | 19.4 | 73.0 | Silt loam |
| Quad. IV | 7.2 | 27.8 | 65.0 | Silt loam | 7.6 | 19.8 | 72.6 | Silt loam |

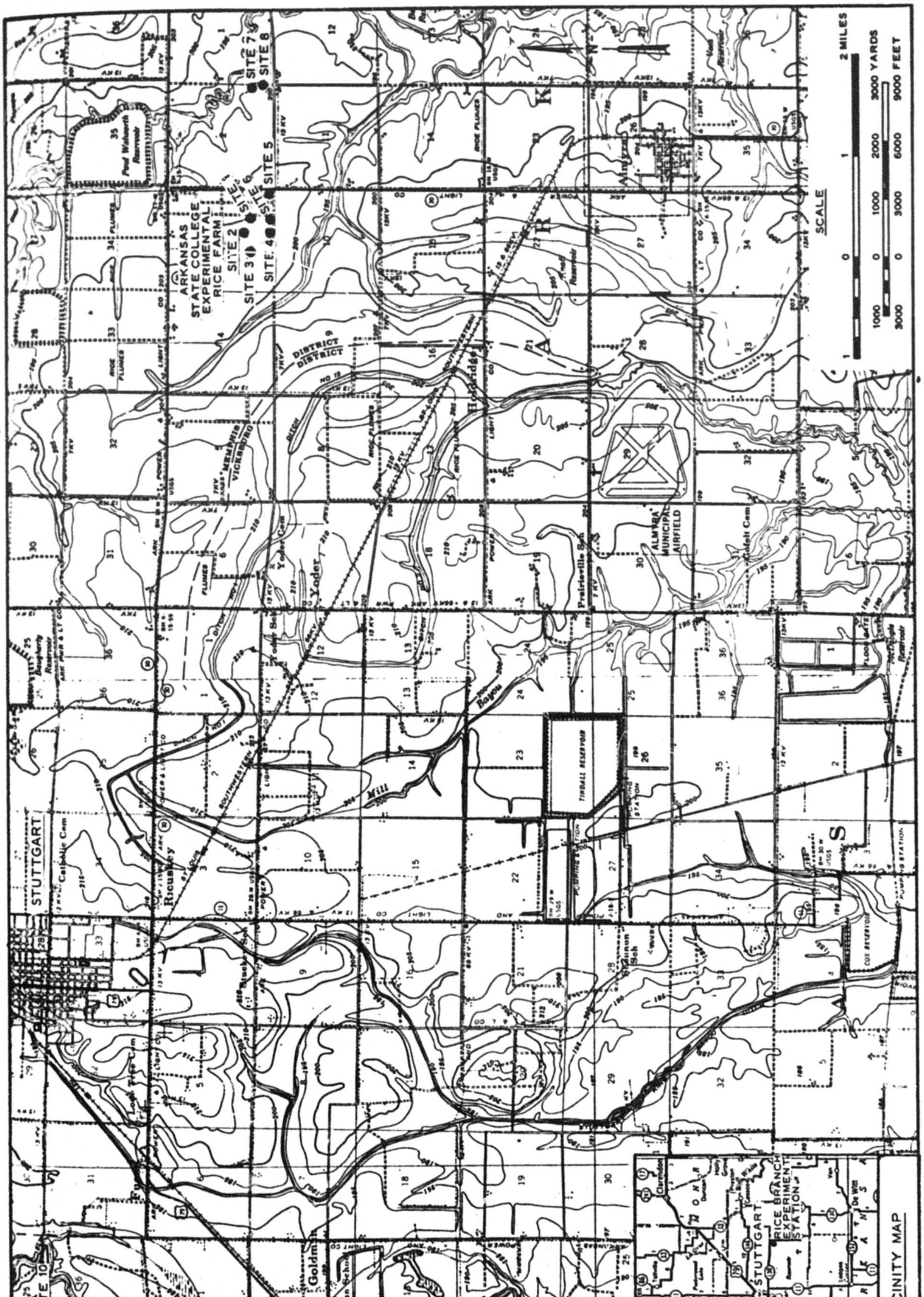
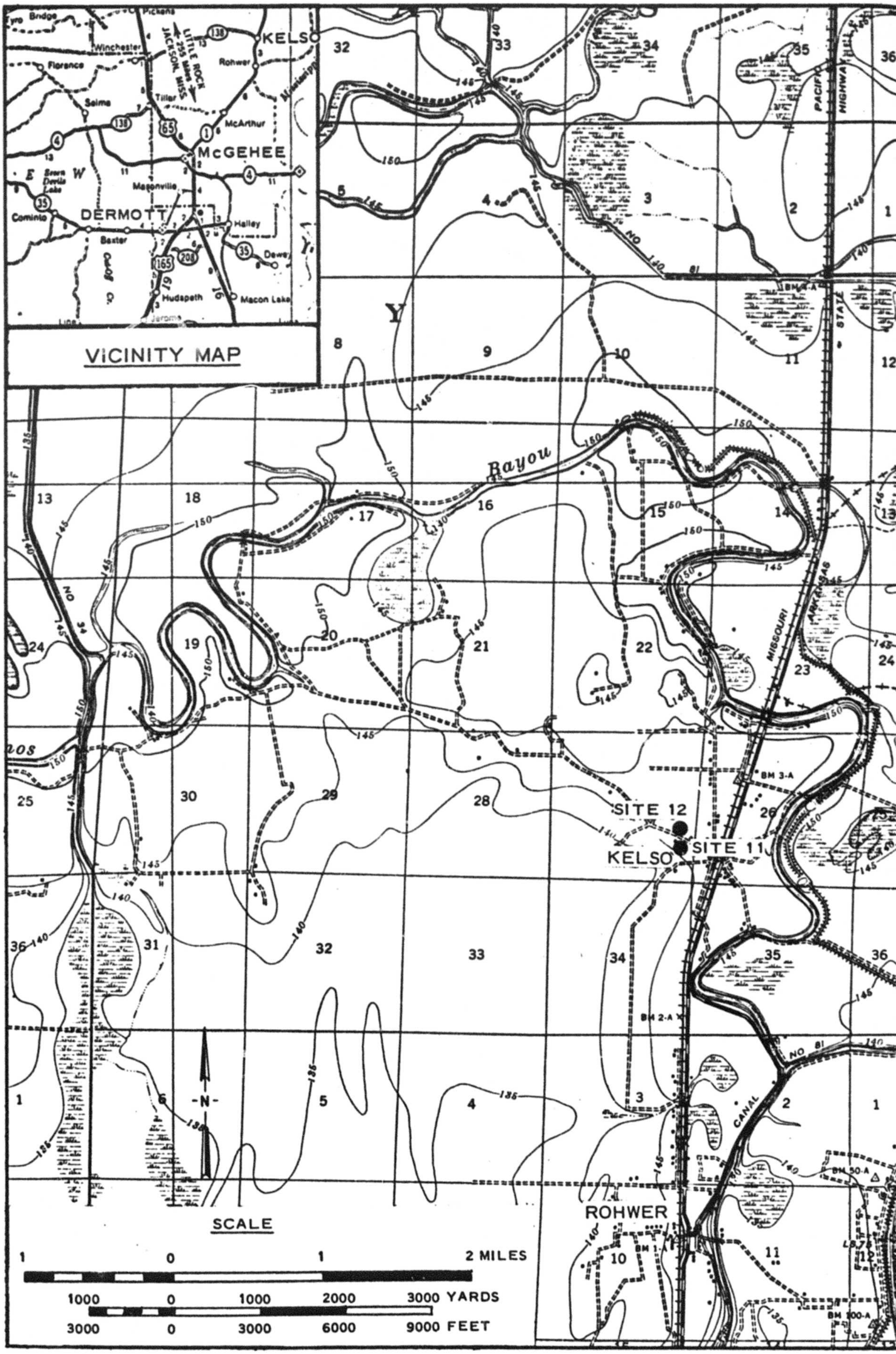

SITE 9
SITE 10
STUTTGART
ARKANSAS STATE COLLEGE EXPERIMENTAL RICE FARM
SITE 2
SITE 3
SITE 4
SITE 5
SITE 6
SITE 7
SITE 8
TINDALL RESERVOIR
ALMYRA MUNICIPAL AIRFIELD
SCALE
2 MILES
3000 YARDS
9000 FEET
VICINITY MAP
RICE BRANCH EXPERIMENT STATION

Fig. 1

Incl 4


VICINITY MAP
KELSO
Rohwer
McArthur
McGEHEE
DERMOTT
Halley
Dewey
Hudspeth
Macon Lake
Winchester
Florence
Selma
Tiller
Pickens
Tyro Bridge
Mesonville
Baxter
Cominto
LITTLE ROCK 25 Miles
JACKSON, MISS.
Bayou
SITE 12
SITE 11
KELSO
ROHWER
MISSOURI
PACIFIC
STATE HIGHWAY
ARKANSAS
CANAL
BM 3-A
BM 2-A
BM 1-A
BM 4-A
BM 50-A
BM 100-A
-N-
SCALE
1 0 1 2 MILES
1000 0 1000 2000 3000 YARDS
3000 0 3000 6000 9000 FEET

Incl 4

Fig. 2

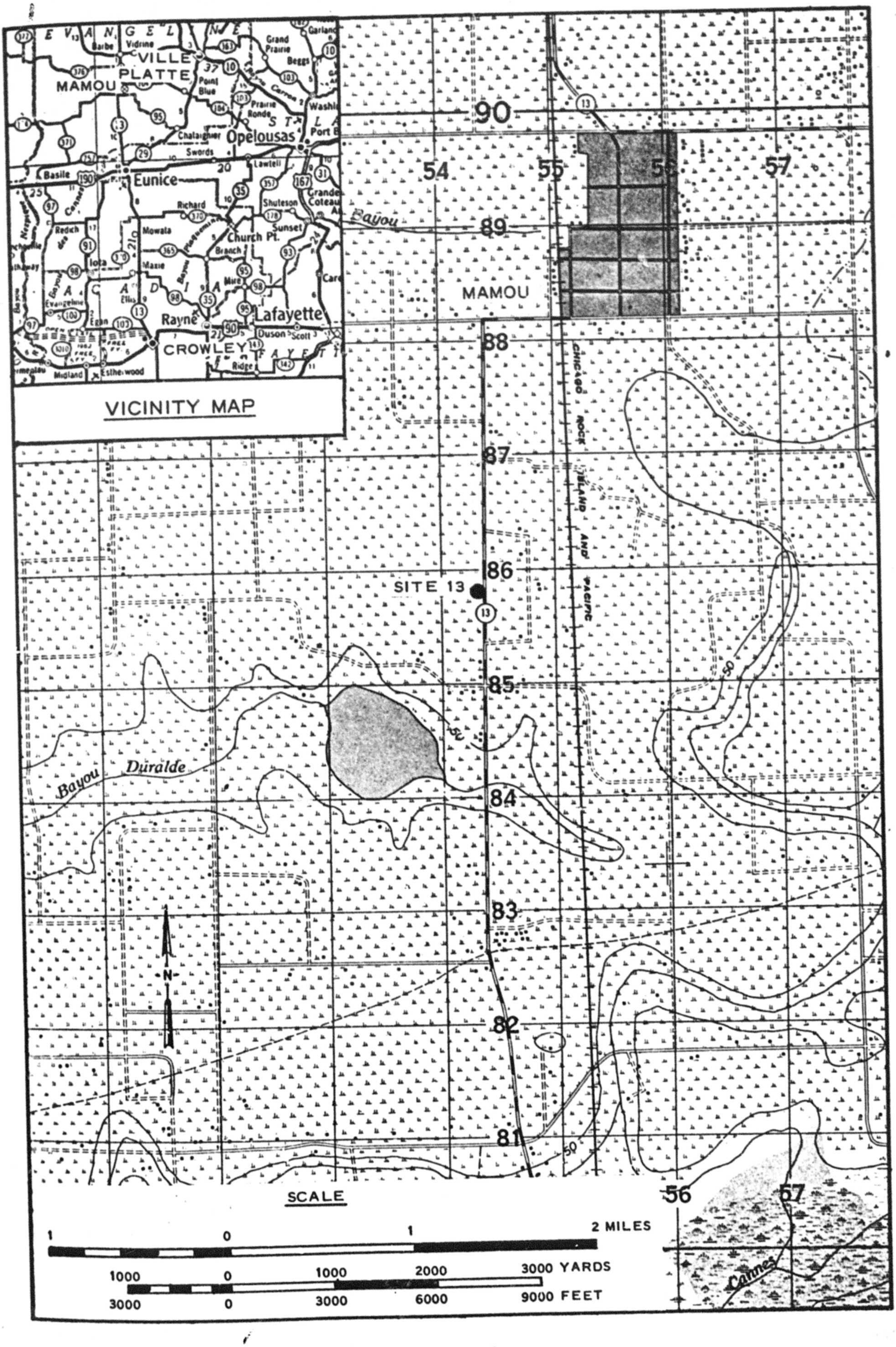
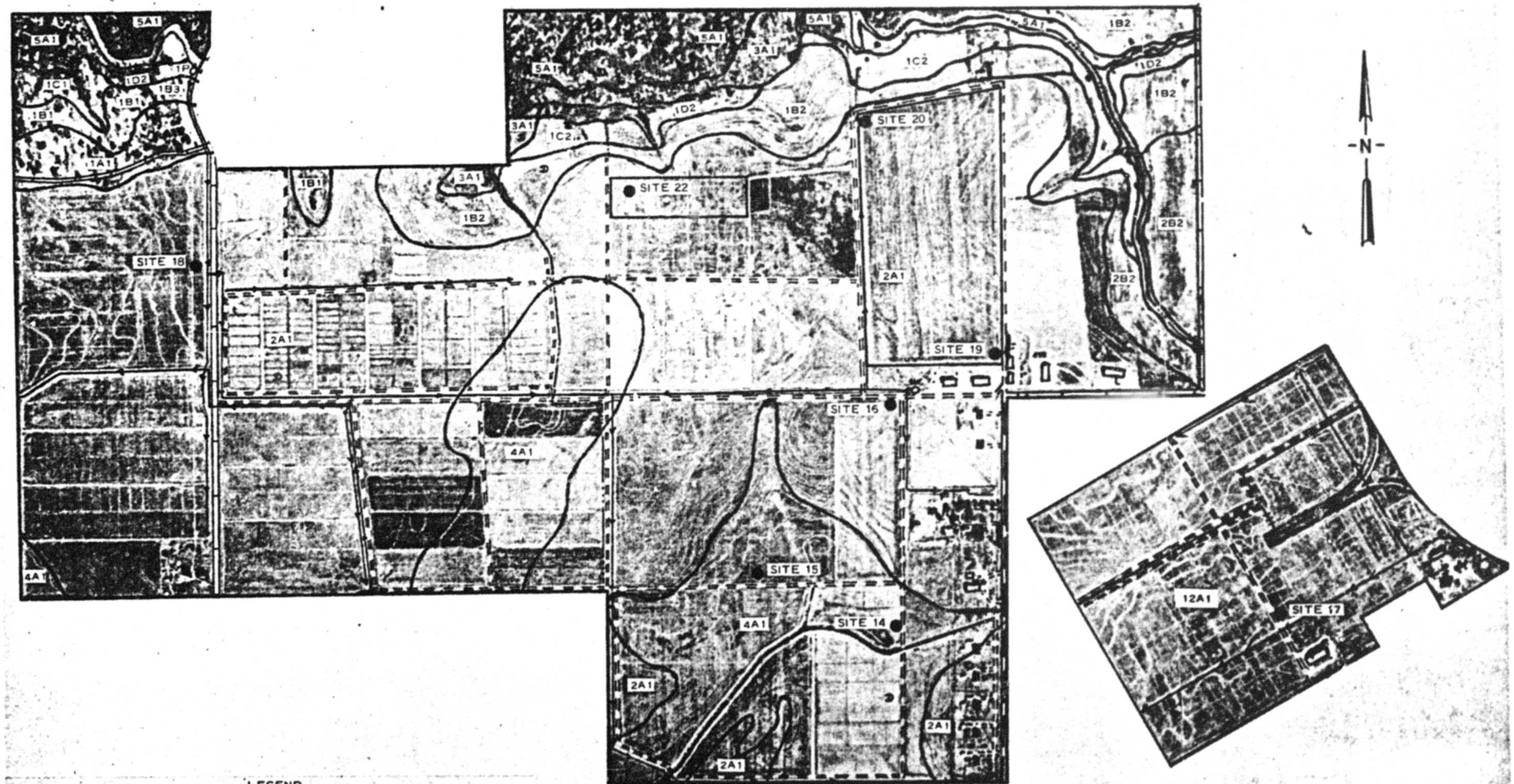

VICINITY MAP
MAMOU
VILLE PLATTE
Opelousas
Eunice
Church Pt.
Lafayette
Rayne
CROWLEY
Iota
Basile
Grand Prairie
Washington
Port Barre
Swords
Lawtell
Sunset
Grand Coteau
Richard
Mowata
Branch
Maxie
Egan
Duson
Scott
Midland
Estherwood
Evangeline
Chataignier
Point Blue
Prairie Ronde
Shuteson
Vidrine
Barbe
Beggs
Garland
Mire
Ridge
Elliott
MAMOU
Bayou
CHICAGO ROCK ISLAND AND PACIFIC
SITE 13
Bayou Duralde
Cannes
50
90
89
88
87
86
85
84
83
82
81
54
55
56
57
N
SCALE
1
0
1
2 MILES
1000
0
1000
2000
3000 YARDS
3000
0
3000
6000
9000 FEET

Fig. 3

Incl 4




**LEGEND**

| | |
|---|---|
| 1A1 | ACADIA SILT LOAM, 0 TO 1 PERCENT SLOPES |
| 1B1 | ACADIA SILT LOAM, 1 TO 3 PERCENT SLOPES |
| 1B2 | ACADIA SILT LOAM, 1 TO 3 PERCENT SLOPES, ERODED |
| 1B3 | ACADIA CLAY, 1 TO 3 PERCENT SLOPES, SEVERELY ERODED |
| 1C1 | ACADIA SILT LOAM, 3 TO 5 PERCENT SLOPES |
| 1C2 | ACADIA SILT LOAM, 3 TO 5 PERCENT SLOPES, ERODED |
| 1D2 | SLOPING SILTY AND CLAYEY LAND |
| 2A1 | CROWLEY SILT LOAM, 0 TO 1 PERCENT SLOPES |
| 2B2 | CROWLEY SILT LOAM, 1 TO 3 PERCENT SLOPES, ERODED |
| 3A1 | JEANERETTE SILT LOAM, HEAVY SUBSOIL, 0 TO 1 PERCENT SLOPES |
| 4A1 | MIDLAND SILT LOAM, 0 TO 1 PERCENT SLOPES |
| 5A1 | WET ALLUVIAL LAND |
| 12A1 | CROWLEY-MIDLAND SILT LOAMS, 0 TO 1 PERCENT SLOPES |

**SCALE**

500 0 500 1000 1500 2000 FEET

Fig. 4

Incl 4


VICINITY MAP
EVANGELINE
VILLE PLATTE
MAMOU
Opelousas
Eunice
Basile
Church Pt.
Lafayette
Rayne
CROWLEY
LOUISIANA STATE UNIVERSITY
EXPERIMENT
STATION
AdB
MaA
CrA
CrB
28
27
SITE 21
LEGEND
AdB ACADIA SILT LOAM, 1 TO 3 PERCENT SLOPES
AwA ACADIA-WRIGHTSVILLE SILT LOAM, 0 TO 1 PERCENT SLOPES
CrA CROWLEY SILT LOAM, 0 TO 1 PERCENT SLOPES
CrB CROWLEY SILT LOAM, 1 TO 3 PERCENT SLOPES
MaA MIDLAND SILT LOAM, 0 TO 1 PERCENT SLOPES
Sd SLOPING LAND, LOAMY AND CLAYEY SEDIMENTS
Wa WET ALLUVIAL LAND
-N-
CROWLEY
SCALE
0.5 0 0.5 MILES
800 0 800 YARDS
2400 0 2400 FEET

Fig. 5

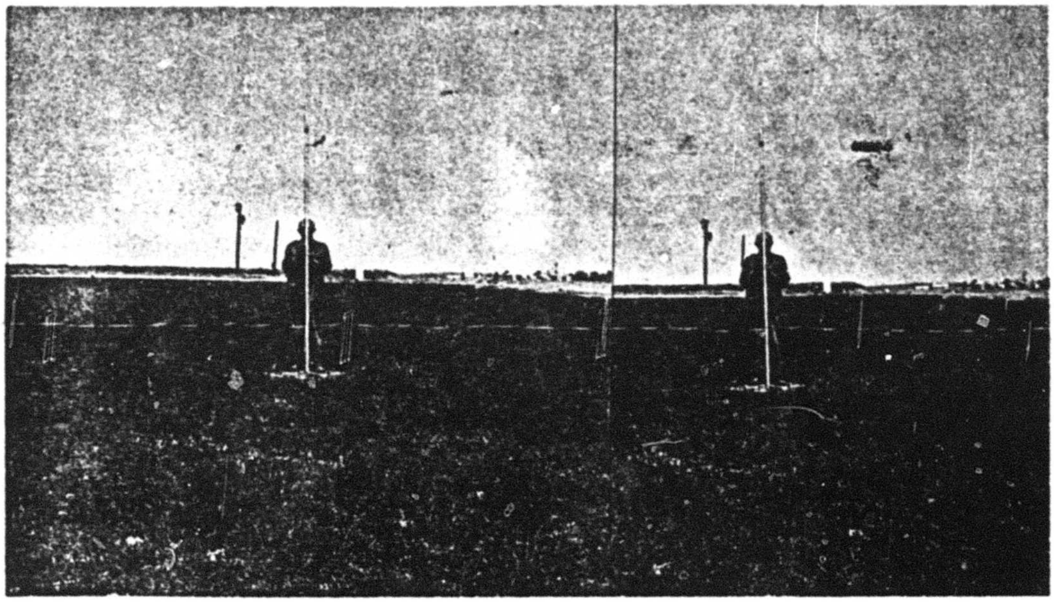


Fig. 1

Site 1. Rice Branch Experiment Station,
Stuttgart, Ark.

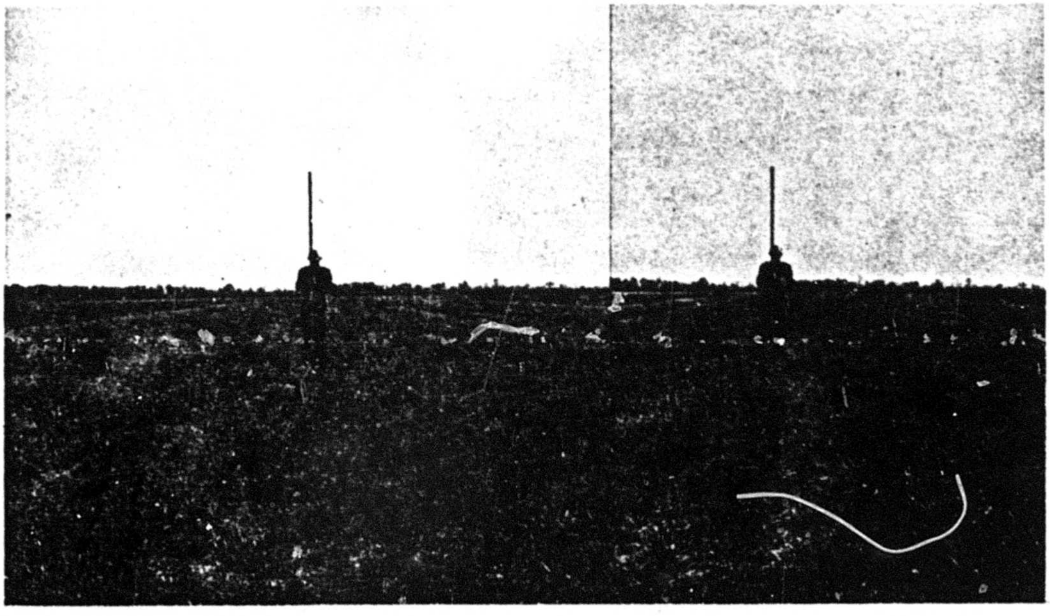


Fig. 2

Site 2. Rice Branch Experiment Station,
Stuttgart, Ark.

Incl 5

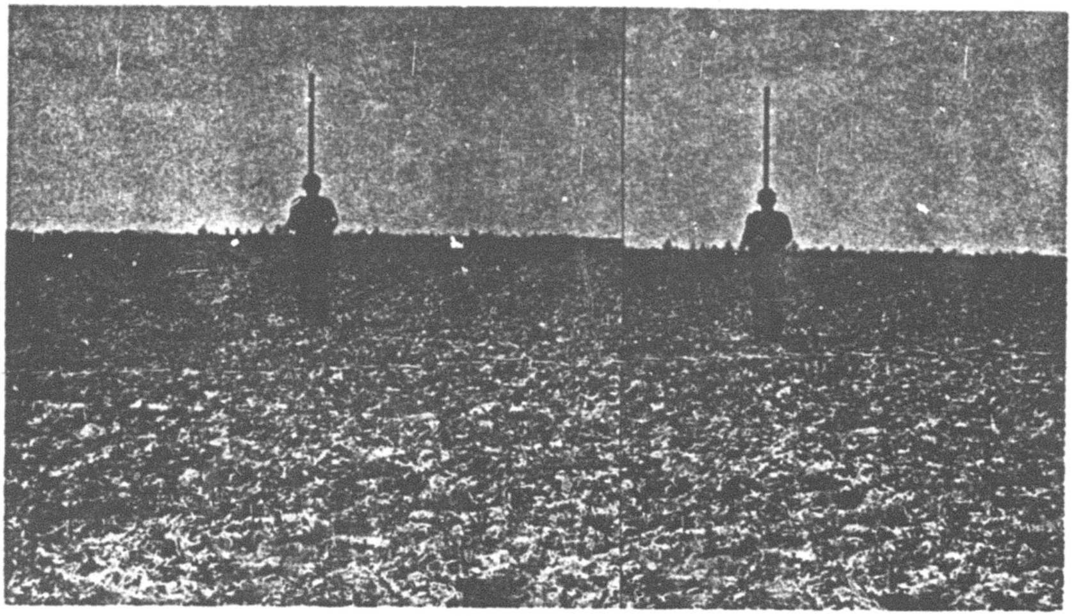


Fig. 3

Site 3. Rice Branch Experiment Station, Stuttgart, Ark.

Fig. 4

Site 4. Rice Branch Experiment Station, Stuttgart, Ark.

Incl 5

Fig. 5

Site 5. Rice Branch Experiment Station,
Stuttgart, Ark.

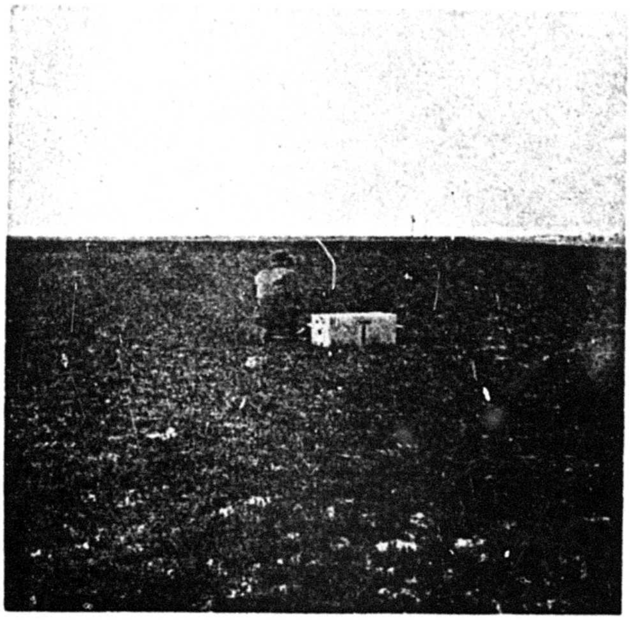


Fig. 6

Site 6. Rice Branch Experiment Station,
Stuttgart, Ark.

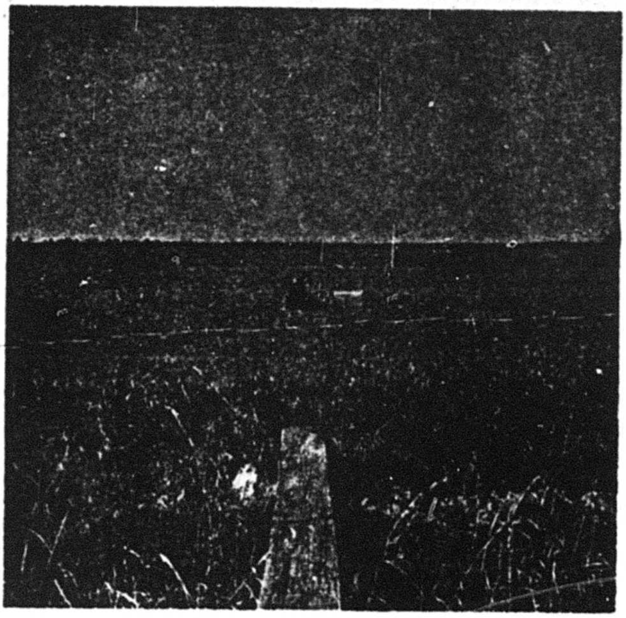


Fig. 7

Site 7. Rice Branch Experiment Station,
Stuttgart, Ark.

Fig. 8

Site 8. Rice Branch Experiment Station,
Stuttgart, Ark.

Fig. 9

Site 9. Bormann Farm,
Stuttgart, Ark.

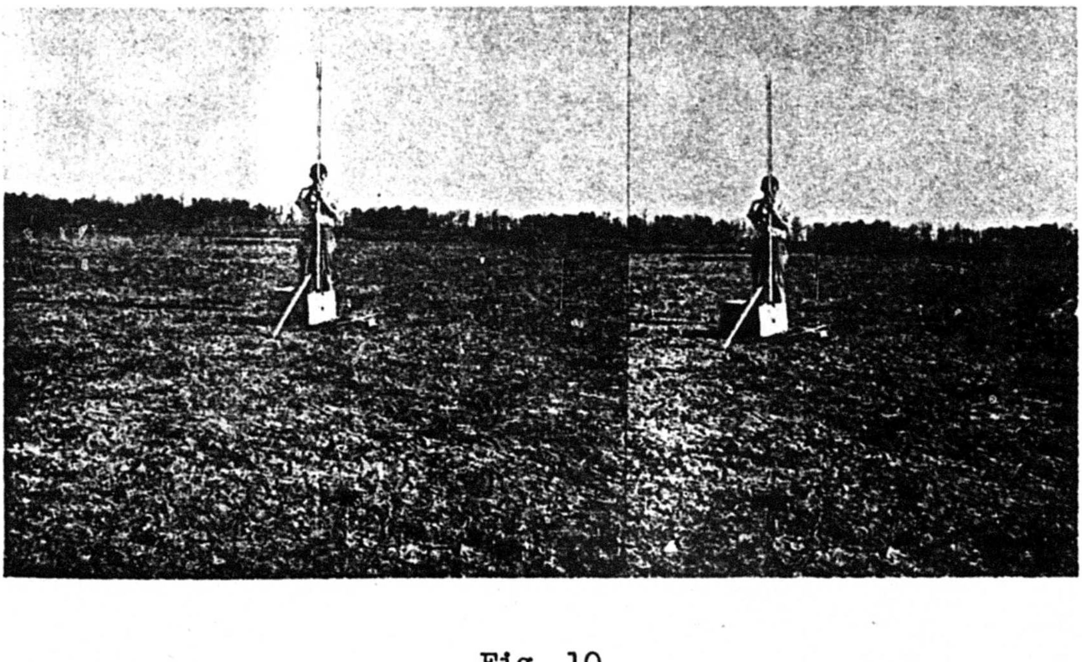


Fig. 10

Site 10. Bormann Farm,
Stuttgart, Ark.

Fig. 11

Site 11. Southeast Agricultural Experiment Station,
Kelso. Ark.

Fig. 12

Site 12. Southeast Agricultural Experiment Station,
Kelso, Ark.

Incl 5

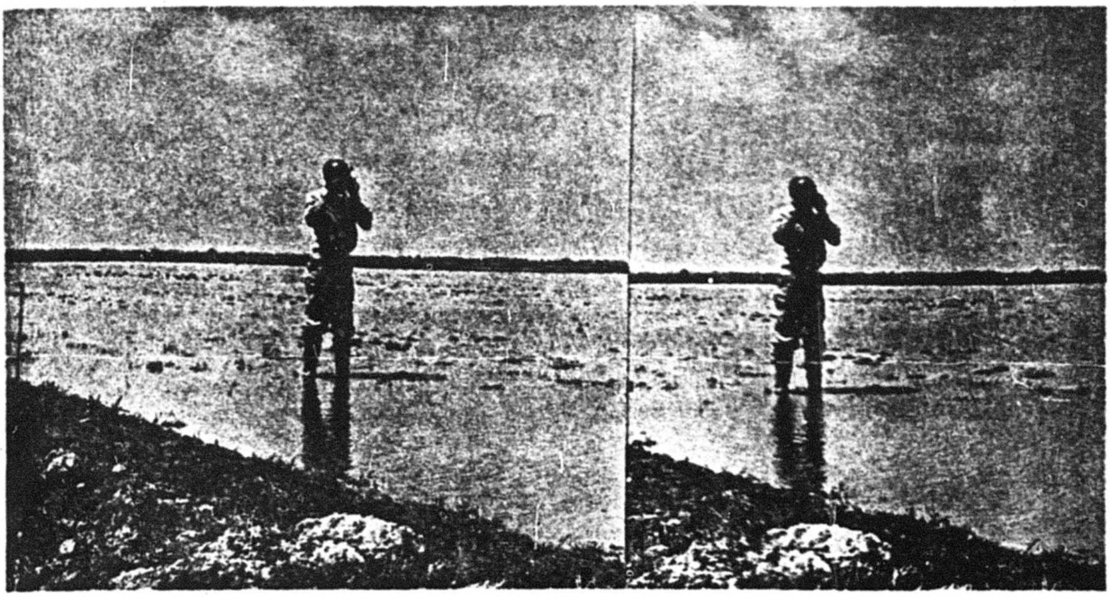


Fig. 13

Site 13. Fuselier Farm,
Mamou, La.

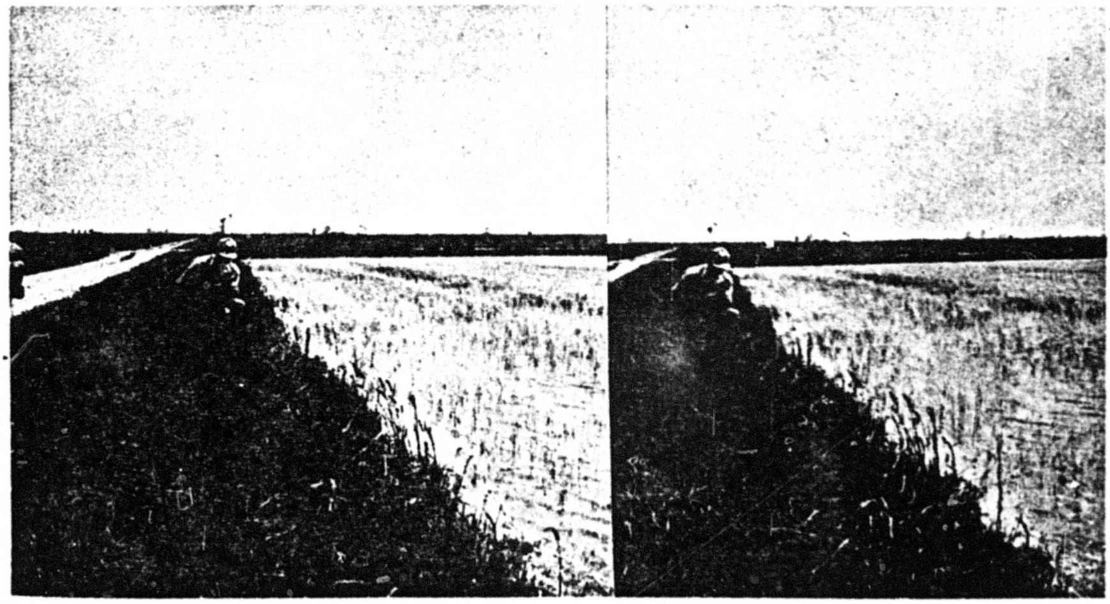


Fig. 14

Site 14. Rice Experiment Station,
Crowley, La.

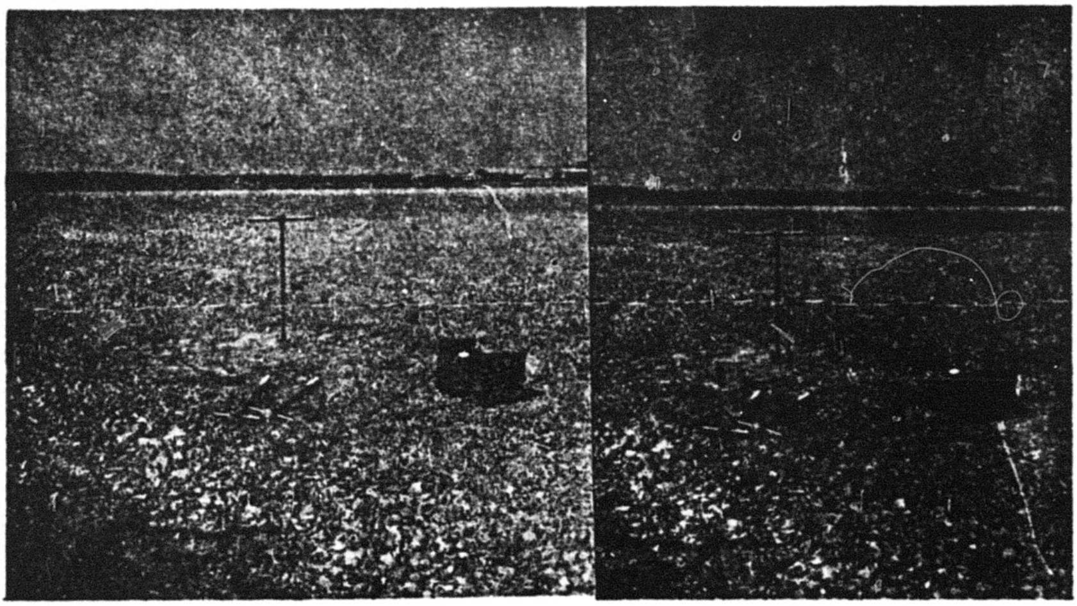


Fig. 15

Site 15. Rice Experiment Station,
Crowley, La.

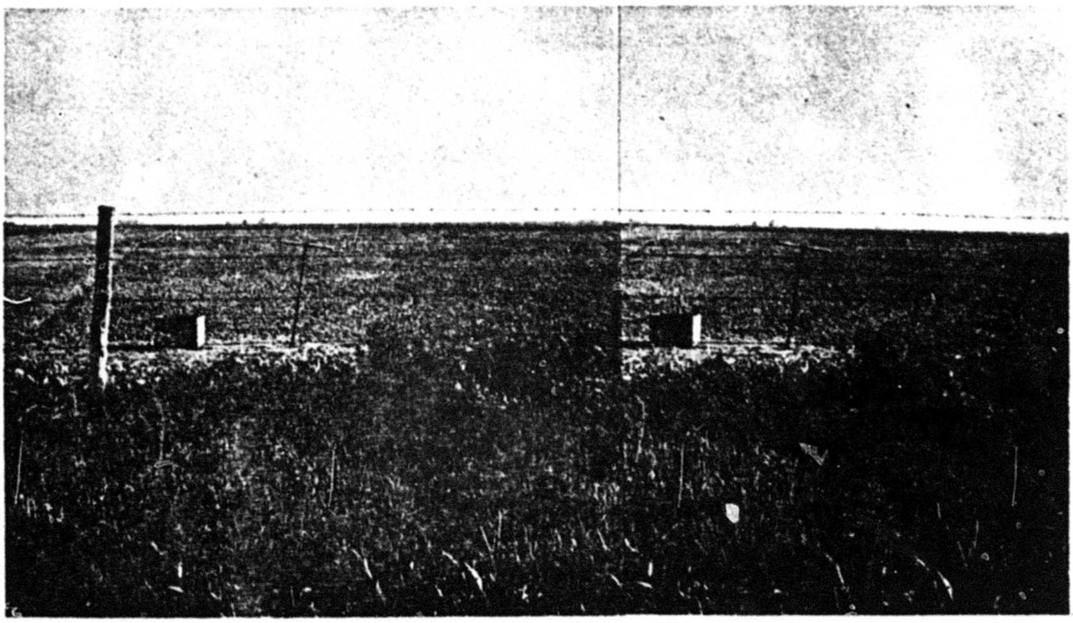


Fig. 16

Site 16. Rice Experiment Station,
Crowley, La.

Incl 5

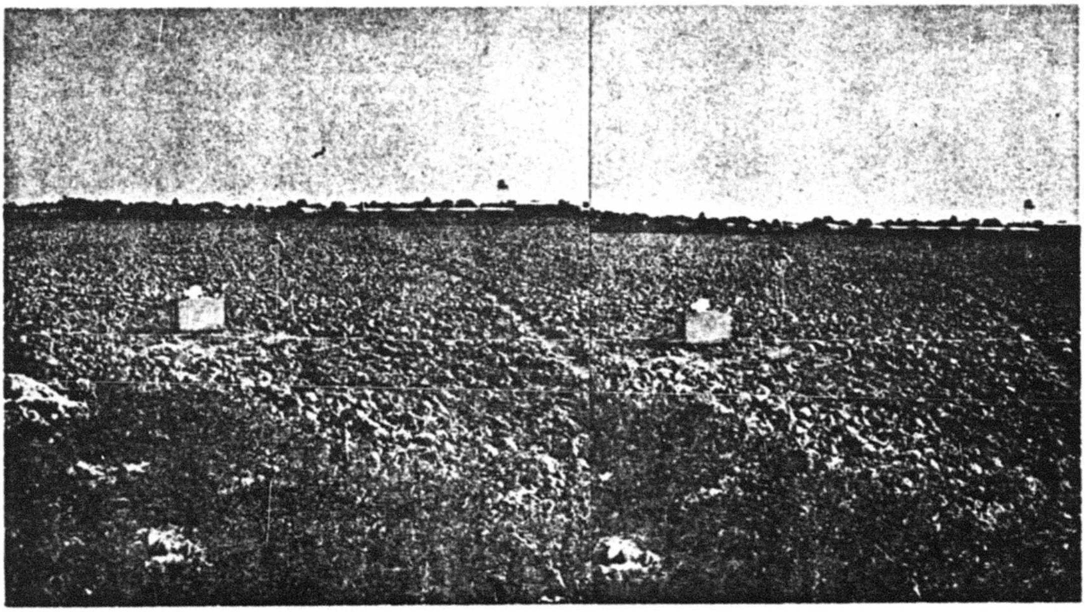


Fig. 17

Site 17. Rice Experiment Station,
Crowley, La.

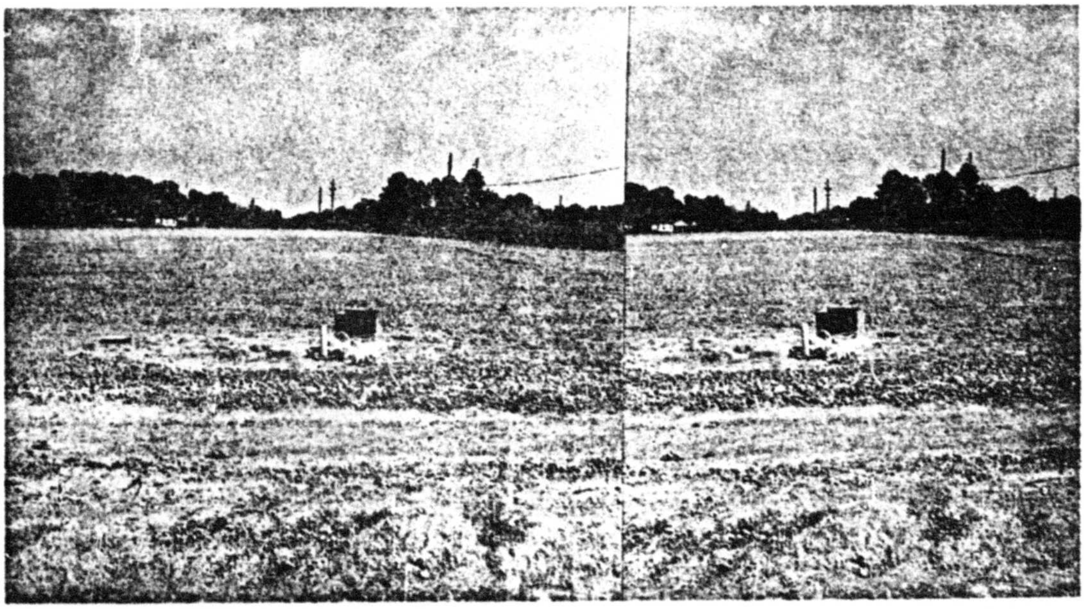


Fig. 18

Site 18. Rice Experiment Station,
Crowley, La.

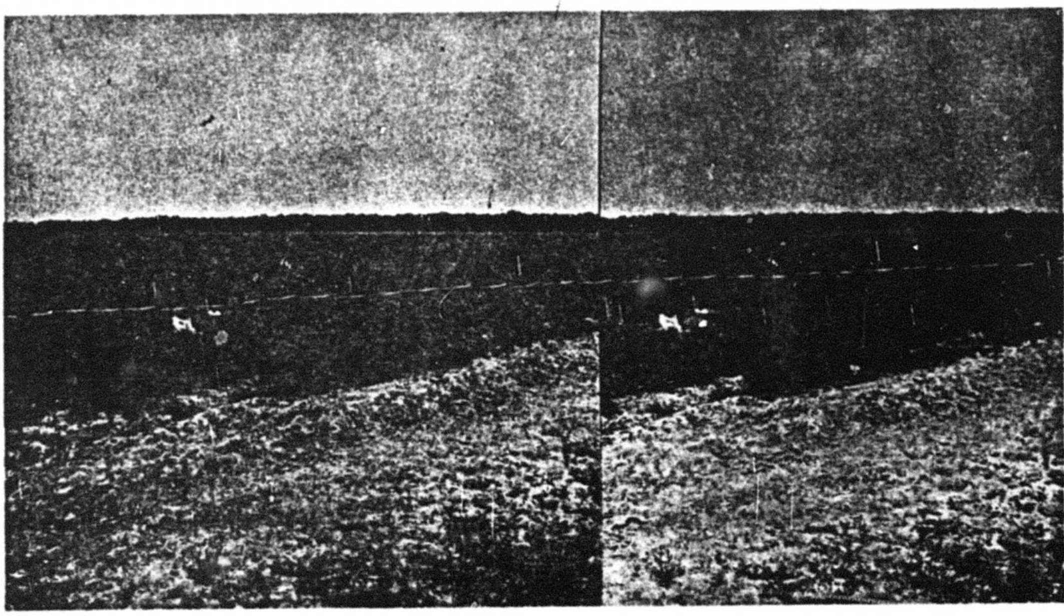


Fig. 19

Site 19. Rice Experiment Station,
Crowley, La.

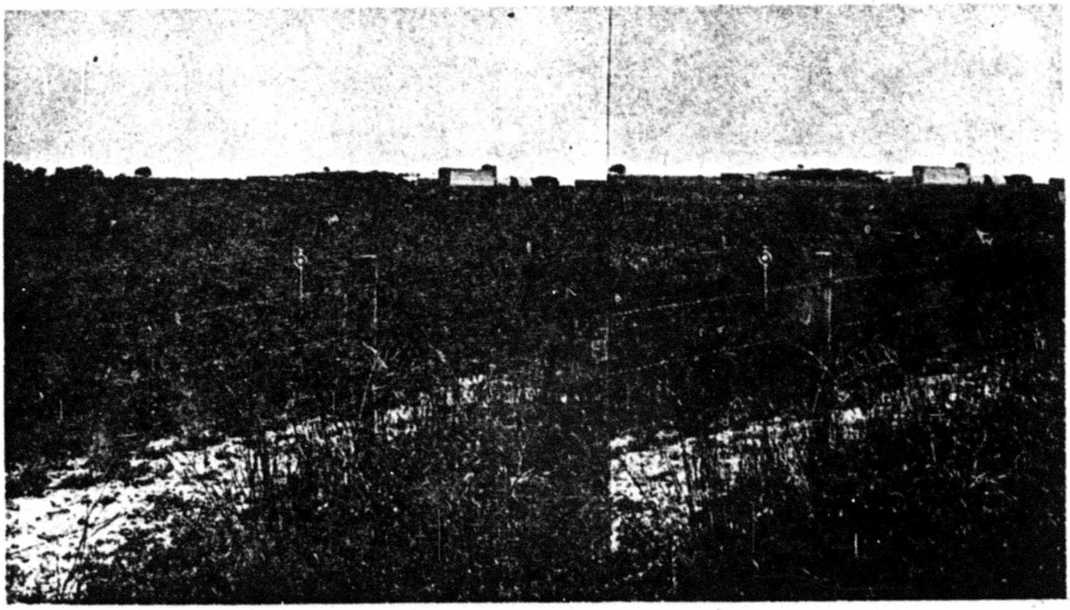


Fig. 20

Site 20. Rice Experiment Station,
Crowley, La.

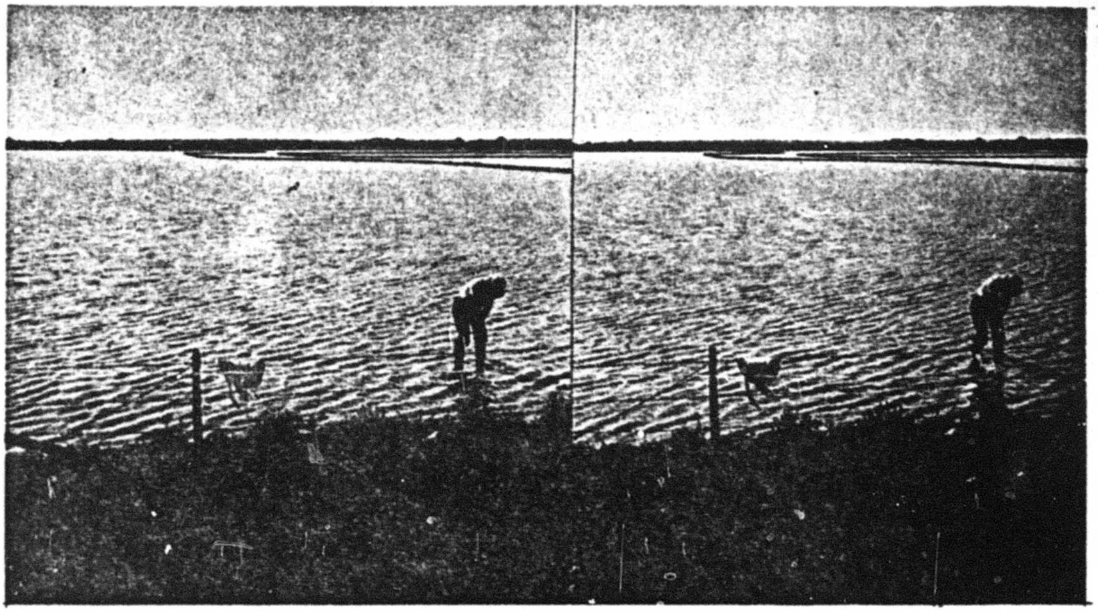


Fig. 21

Site 21. Leonard Farm,
Crowley, La.

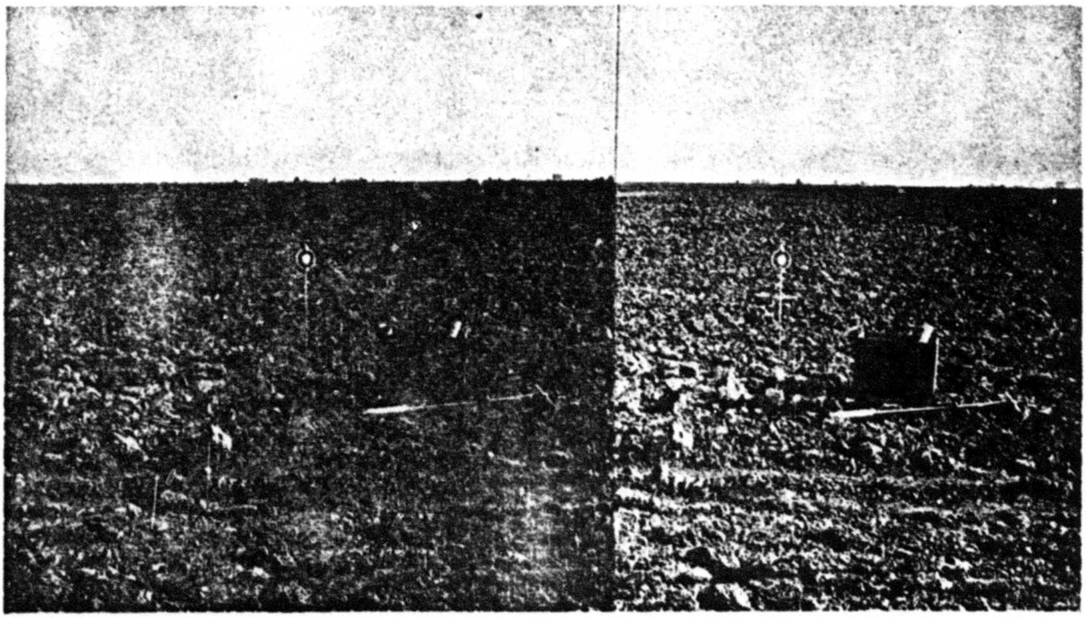


Fig. 22

Site 22. Rice Experiment Station,
Crowley, La.

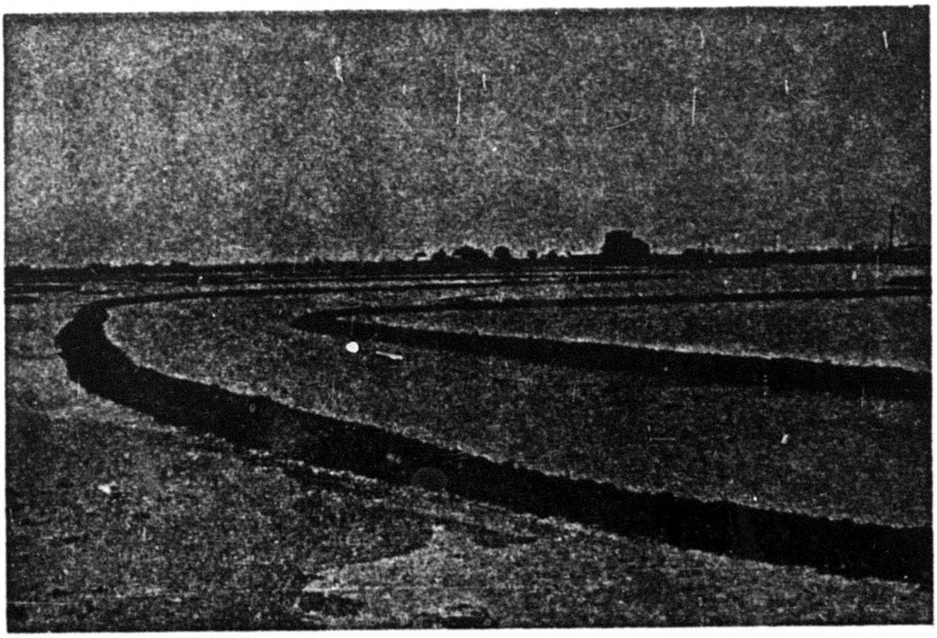


Fig. 23

Typical dikes on Fuselier farm,
Mamou, La.

Preliminary Summary, Soil and [illegible]

| Site Location | Site No. | Soil Type | Vegetation | USDA Texture Classification 0-6 in. | USDA Texture Classification 6-12 in. | USCS Classification 0-6 in. | USCS Classification 6-12 in. | Average Cone Index at Indicated Depths, in.: Surface | 3 | 6 | 9 | 12 | 15 | 18 | 24 | 30 | 0-6 | 6-12 | Remolding Index 0-6 in. | Remolding Index 6-12 in. | Rating Cone Index 0-6 in. | Rating Cone Index 6-12 in. | Moisture Content by Weight, % 0-6 in. | Moisture Content by Weight, % 6-12 in. | Density lb/cu ft 0-6 in. | Density lb/cu ft 6-12 in. | % Saturation* 0-6 in. | % Saturation* 6-12 in. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rice Branch Experiment Station, Stuttgart, Ark. | 1 | Crowley | Herbaceous | [illegible] | [illegible] | [illegible] | CL | [illegible] | [illegible] | 507 | 414 | 319 | 335 | [illegible] | --- | --- | 335 | 413 | NT† | 0.84 | --- | 347 | 18.1 | 21.3 | 84.5 | 97.6 | 51.1 | 81.3 | Grass 2 to 3 in. high on field |
| | 2 | Stuttgart | Herbaceous | [illegible] | [illegible] | CL | CL | 124 | 203 | [illegible] | 242 | 204 | 215 | 226 | --- | --- | 310 | 353 | 0.92 | 0.53 | 285 | 189 | 24.2 | 24.5 | 87.4 | 91.5 | 73.5 | 80.4 | Field covered with oats 4 to 6 in. high |
| | 3 | Crowley | Bare | SiL | SiL | CL | CL | [illegible] | [illegible] | [illegible] | 162 | 199 | 166 | 143 | --- | --- | 163 | 177 | 0.99 | 0.65 | 161 | 115 | 24.1 | 26.6 | 90.7 | 91.1 | 79.4 | 86.5 | Field had been disked |
| | 4 | Crowley | Herbaceous | SiL | SiL | CL | CL | [illegible] | 412 | 512 | 470 | 369 | 370 | 365 | --- | --- | 386 | 450 | -- | -- | --- | --- | 18.4 | 23.1 | 84.1 | 89.4 | 51.5 | 72.1 | Field covered with oats 4 to 6 in. high |
| | 5 | Midland | Bare | SiL | SiL | CL | CL | 192 | 215 | 432 | 683 | 490 | 374 | 372 | --- | --- | 280 | 535 | -- | -- | --- | --- | 20.1 | 21.5 | -- | -- | -- | -- | Field recently disked |
| | 6 | Crowley | Herbaceous | SiL | SiL | CL | CL | 257 | 343 | 425 | 567 | 360 | 283 | 358 | --- | --- | [illegible] | 450 | -- | 1.09 | --- | 491 | 17.4 | 21.4 | -- | 93.8 | -- | 74.3 | Grass 2 to 3 in. high on field |
| | 7 | Crowley | Bare | SiL | SiL | CL | CL | 21 | 262 | 295 | 257 | 257 | 224 | 220 | --- | --- | 193 | 270 | -- | -- | --- | --- | 23.4 | 31.2 | 86.8 | 80.8 | 70.0 | 79.0 | Field recently disked |
| | 8 | Midland | Bare | SiL | SiL | CL | CL | 30 | 326 | 457 | 498 | 354 | 241 | 270 | --- | --- | 270 | 436 | -- | 0.75 | --- | 327 | 20.4 | 23.1 | -- | 87.4 | -- | 68.6 | Field recently disked |
| Bormann Farm, Stuttgart, Ark. | 9 | Perry | Sparsely vegetated | C | C | CH | CH | 20 | 64 | 72 | 114 | 112 | --- | 94 | 104 | 167 | 52 | 100 | 1.09 | 0.99 | 57 | 99 | 49.3 | 49.6 | 66.0 | 66.5 | 85.2 | 88.4 | Field sparsely vegetated |
| | 10 | Perry | Sparsely vegetated | C | C | CH | CH | 41 | 82 | 97 | 116 | 112 | --- | 102 | 90 | 118 | 73 | 108 | 1.06 | 0.98 | 77 | 106 | 44.8 | 47.4 | 68.4 | 70.6 | 84.9 | 93.6 | Field sparsely vegetated |
| Southeast Agricultural Experiment Station, Kelso, Ark. | 11 | Buxton (?) | Bare | C | C | CH | CH | 50 | 35 | 46 | 56 | 69 | --- | 85 | 94 | 117 | 44 | 57 | 0.89 | 1.02 | 39 | 58 | 49.8 | 45.8 | 65.4 | 68.1 | 87.4 | 85.0 | Experimental rice plot, bare |
| | 12 | Buxton (?) | Bare | C | C | CH | CH | 22 | 158 | 163 | 150 | 129 | --- | 134 | 162 | 200 | 114 | 147 | -- | 0.92 | --- | 135 | 28.4 | 28.2 | -- | 76.7 | -- | 64.7 | Field had been disked |
| Fuselier Farm, Mamou, La. | 13 | Crowley | Bare | SiL | SiL | CL | CL | 6 | 43 | 149 | 106 | 131 | --- | 184 | 238 | 282 | 66 | 128 | -- | 0.74 | --- | 95 | 27.2 | 21.7 | -- | 99.5 | -- | 86.9 | Field flooded, 2 to 6 in. [illegible] |
| Rice Experiment Station, Crowley, La. | 14 | Midland | Herbaceous | SiL | SiL | CL | CL | 3 | 90 | 192 | 181 | 154 | --- | 156 | 151 | 186 | 95 | 175 | 0.32 | 0.55 | 30 | 96 | 25.6 | 28.6 | 92.5 | 92.9 | 88.3 | 97.2 | Rice plants 9 in. high. Field flooded, 4 to 6 in. water |
| | 15 | Midland | Bare | SiL | SiL | CL | CL | 28 | 325 | 556 | 390 | 271 | 218 | 208 | --- | --- | 303 | 406 | -- | 0.90 | --- | 365 | 15.8 | 21.2 | -- | 96.2 | -- | 78.1 | Field recently disked |
| | 16 | Crowley | Bare | SiL | SiL | CL | CL | 21 | 393 | 480 | 622 | 329 | 332 | 359 | --- | --- | 298 | 477 | -- | 0.76 | --- | 363 | 13.8 | 18.8 | -- | 98.8 | -- | 74.0 | Field recently disked |
| | 17 | Crowley and Midland, complex | Bare | SiL | SiL | CL | CL | 22 | 490 | 304 | 284 | 260 | 251 | 209 | --- | --- | 125 | 283 | -- | -- | --- | --- | 18.0 | 25.6 | -- | -- | -- | -- | Field recently disked |
| | 18 | Crowley | Bare | SiL | SiL | CL | CL | 26 | 225 | 304 | 523 | 374 | 272 | 241 | --- | --- | 185 | 400 | -- | 0.89 | --- | 356 | 17.0 | 22.9 | 89.6 | 97.4 | 54.5 | 87.0 | Field recently disked |
| | 19 | Crowley | Herbaceous | SiL | SiL | CL | CL | 750+ | 750+ | 750+ | 750+ | 750+ | --- | --- | --- | --- | 750+ | 750+ | -- | -- | --- | --- | 12.0 | 21.2 | -- | -- | -- | -- | Ryegrass 12 in. high, pasture |
| | 20 | Crowley | Herbaceous | SiL | SiL | CL | CL | 750+ | 750+ | 750+ | 750+ | 750+ | --- | --- | --- | --- | 750+ | 750+ | -- | -- | --- | --- | 8.2 | 12.6 | -- | -- | -- | -- | Ryegrass 12 in. high, pasture |
| Leonards Farm, Crowley, La. | 21 | Crowley | Herbaceous | SiL | SiL | CL | CL | 3 | 5 | 175 | 180 | 111 | --- | 198 | 209 | 216 | 61 | 155 | 0.48 | 0.63 | 29 | 98 | 24.6 | 24.0 | 97.1 | 99.4 | 95.3 | 95.9 | Field flooded, 4 to 6 in. water |
| Rice Experiment Station, Crowley, La. | 22 | Crowley | Herbaceous | SiL | SiL | CL | CL | 19 | 41 | 599 | 431 | 264 | 224 | 192 | --- | --- | 220 | 431 | -- | 0.90 | --- | 388 | 11.5 | 21.4 | -- | 97.7 | -- | 81.9 | Field recently plowed |

Note: All sites located on level terrain.
* Specific gravity of 2.60 used for 0- to 6-in. layers, 2.65 for 6- to 12-in. layers.
† NT, no test.

## Supplemental Soil Data*

| Soil Series | Soil Description** | Depth in. | Horizon | Percentage Passing Sieve No. 40 | Percentage Passing Sieve No. 200 | Percentage Smaller Than 0.05 mm | 0.02 mm | 0.005 mm | 0.002 mm | Liquid Limit | Plasticity Index | Maximum Dry Density lb/cu ft | Optimum Moisture Content for Maximum Dry Density | Moisture Content for 95% of Maximum Dry Density | Textural Classification USDA | USCS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crowley silt loam, 0 to 1% slopes | 1 ft of clayey silt or silty clay over 2 ft of silty clay or fat clay, underlain by 2 ft or more of silty clay. Somewhat poorly drained; free water at 6 ft or more. On broad ridges on pleistocene prairie formation; parent material, old general alluvium. | 7 to 12 | $A_{2g}$ | 100 | 98 | 90 | 62 | 26 | 18 | 27 | 8 | 106.9 | 18.2 | 13.7 to 22.2 | SiL | CL |
| | | 16 to 24 | $B_{2g}$ | 100 | 99 | 94 | 80 | 50 | 42 | 50 | 30 | 102.3 | 21.6 | 15.3 to 25.0 | SiCL | CL |
| | | 24 to 40 | $B_{3g}$ | 100 | 99 | 93 | 75 | 43 | 35 | 50 | 29 | 102.3 | 21.6 | 15.3 to 25.0 | SiC | CL |
| Midland silt loam, 0 to 1% slopes | 3 ft or more of silty clay. Poorly drained; free water at 3 ft or more. In depressions on pleistocene prairie formation; parent material, old general alluvium. | 4 to 10 | $A_{2g}$ | 100 | 99 | 92 | 71 | 34 | 22 | 28 | 9 | 107.5 | 15.9 | 12.5 to 20.2 | SiL | CL |
| | | 10 to 22 | $B_{1g}$ | 100 | 99 | 93 | 74 | 40 | 30 | 31 | 11 | 101.8 | 18.2 | 13.0 to 23.2 | SiCL | CL |
| | | 22 to 40 | $B_{2g}$ | 100 | 99 | 93 | 77 | 49 | 39 | 44 | 22 | 106.5 | 18.1 | 16.1 to 21.7 | SiC | CL |

* Copied from "Soil Survey Acadia Parish, Louisiana," series 1959, issued September 1962.
** Lateral movement of water is so slow that water table does not seriously affect excavation less than 15 ft deep.

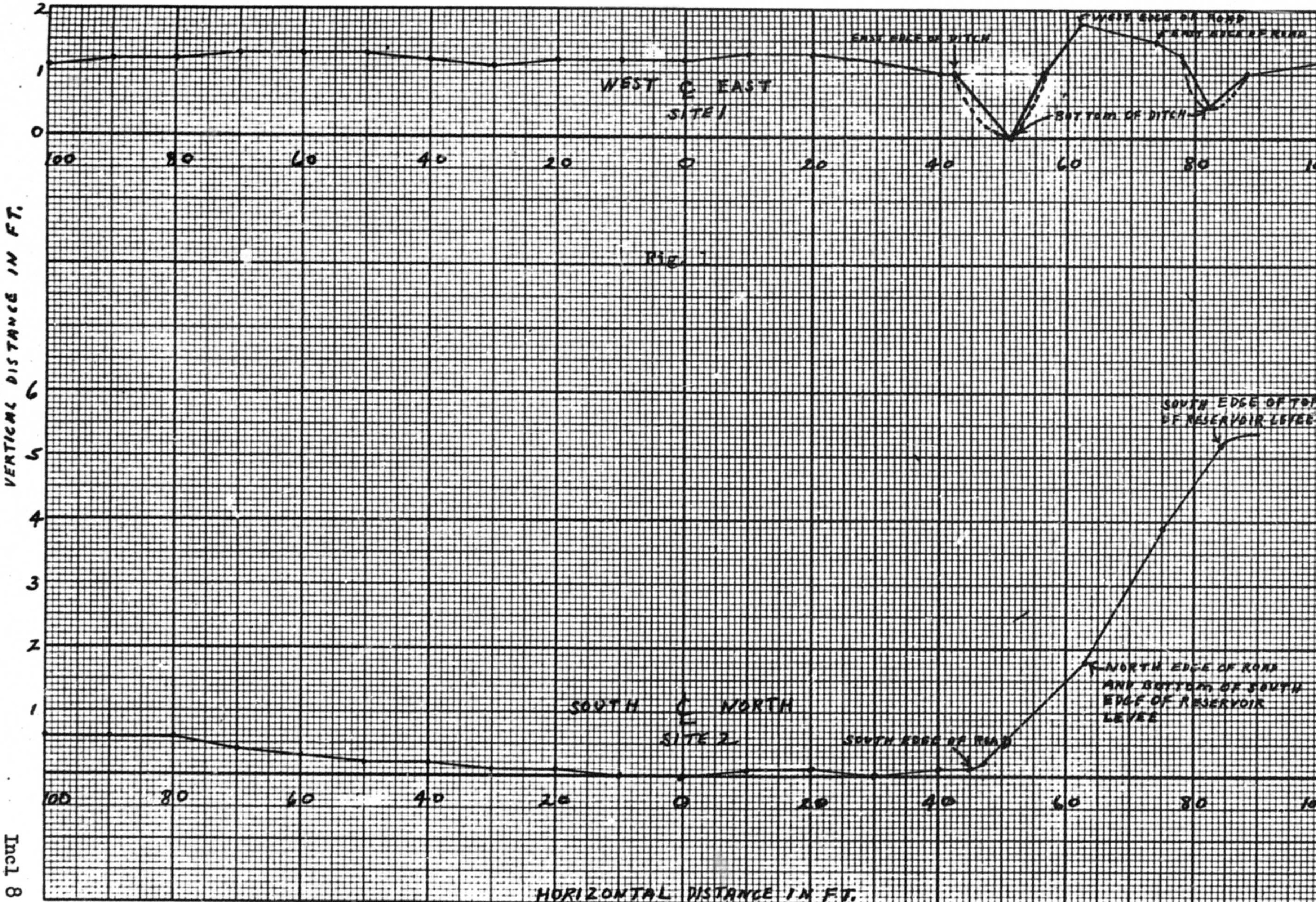

WEST ℄ EAST
SITE 1
EAST EDGE OF DITCH
BOTTOM OF DITCH
WEST EDGE OF ROAD
E AND EDGE OF ROAD
Fig. 1
SOUTH ℄ NORTH
SITE 2
SOUTH EDGE OF ROAD
NORTH EDGE OF ROAD AND BOTTOM OF SOUTH EDGE OF RESERVOIR LEVEE
SOUTH EDGE OF TOP OF RESERVOIR LEVEE
VERTICAL DISTANCE IN FT.
HORIZONTAL DISTANCE IN FT.
100 80 60 40 20 0 20 40 60 80 100
0 1 2 3 4 5 6

Fig. 2

Incl 8

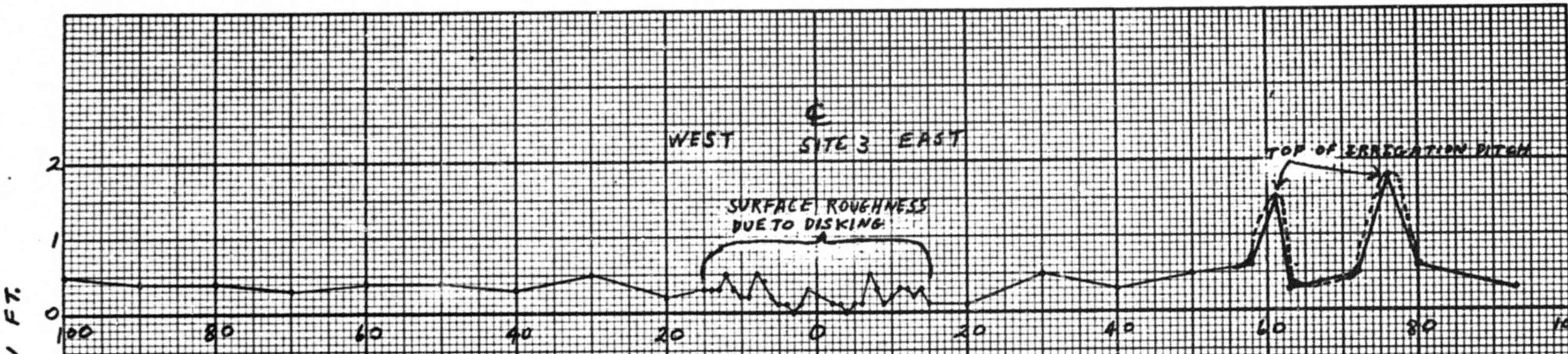



Fig. 3

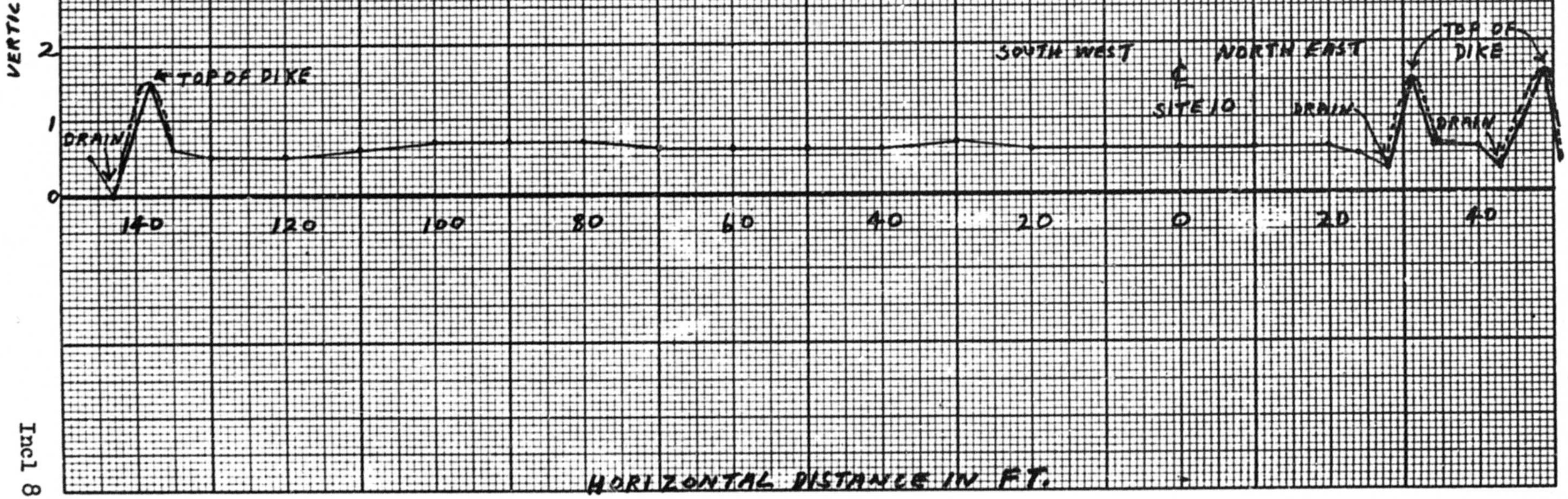


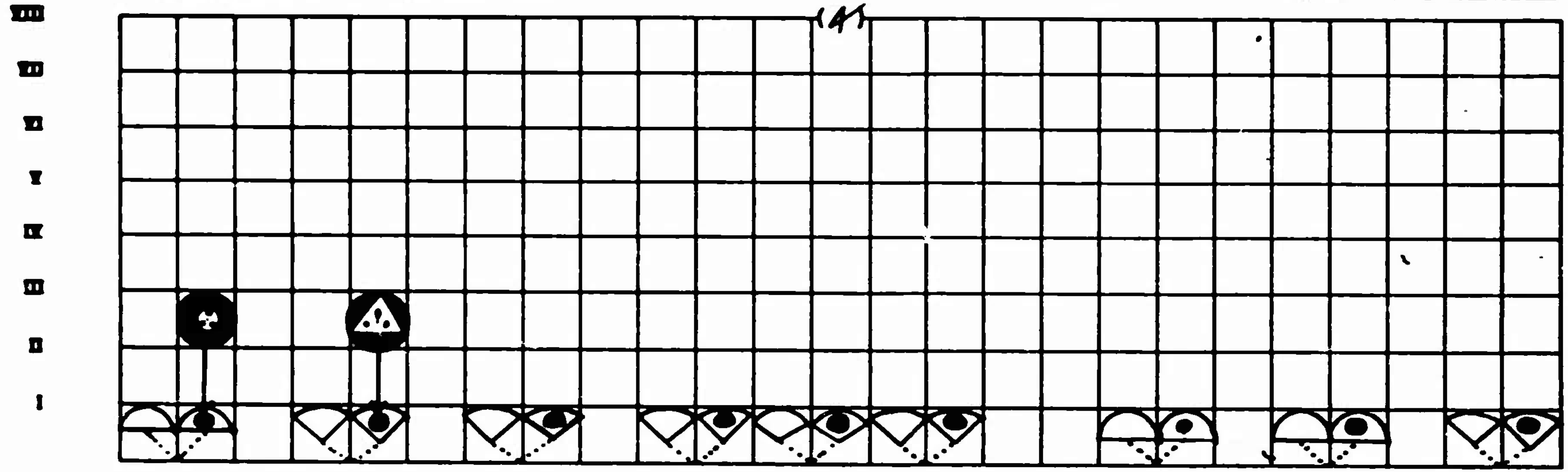

Fig. 4.

Incl 8

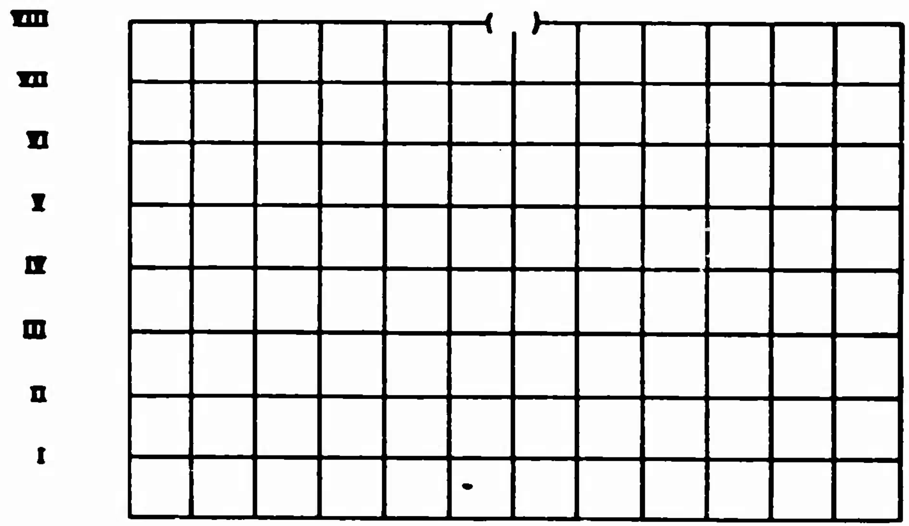
# VEGETATION STRUCTURAL DIAGRAM

LOCATION Site 1

DATE



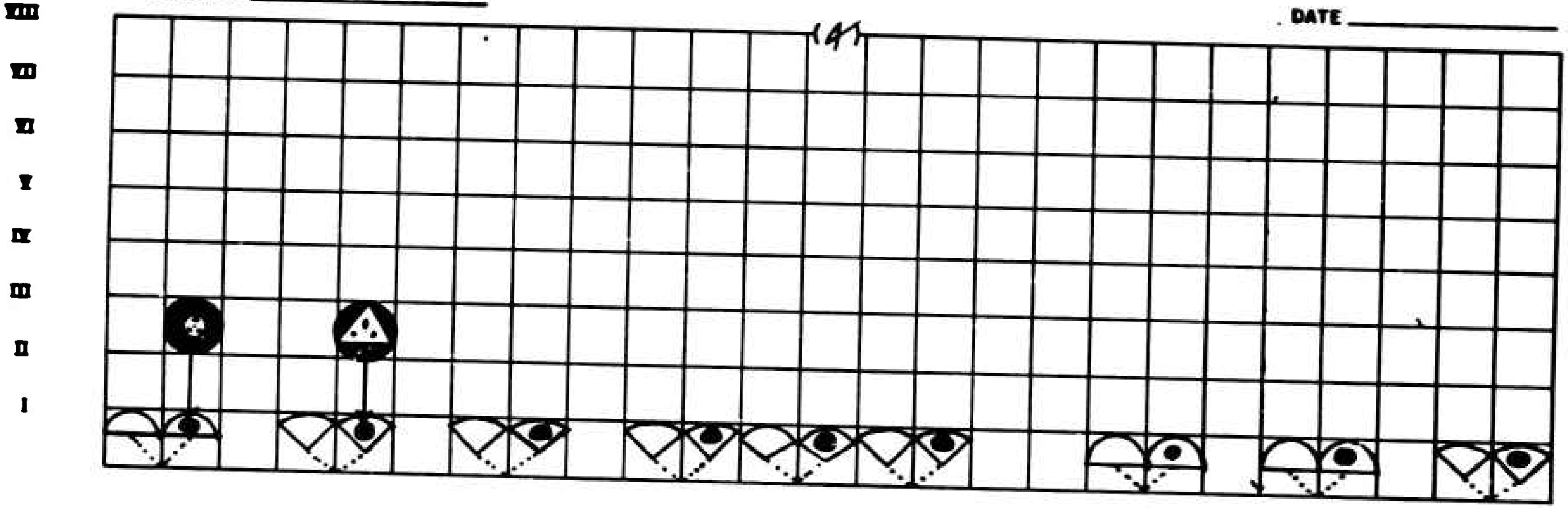

SAMPLE AREA DIAMETER



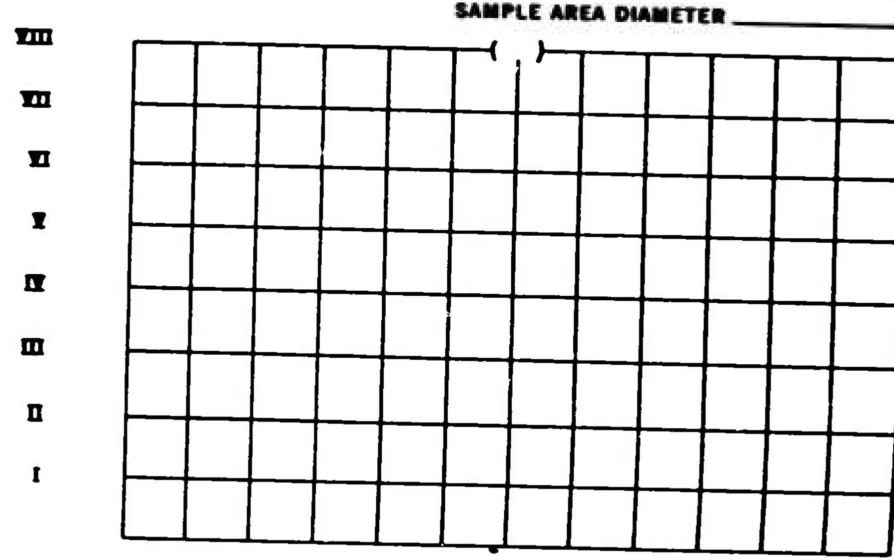
# VEGETATION STRUCTURAL DIAGRAM

LOCATION Site 6

DATE



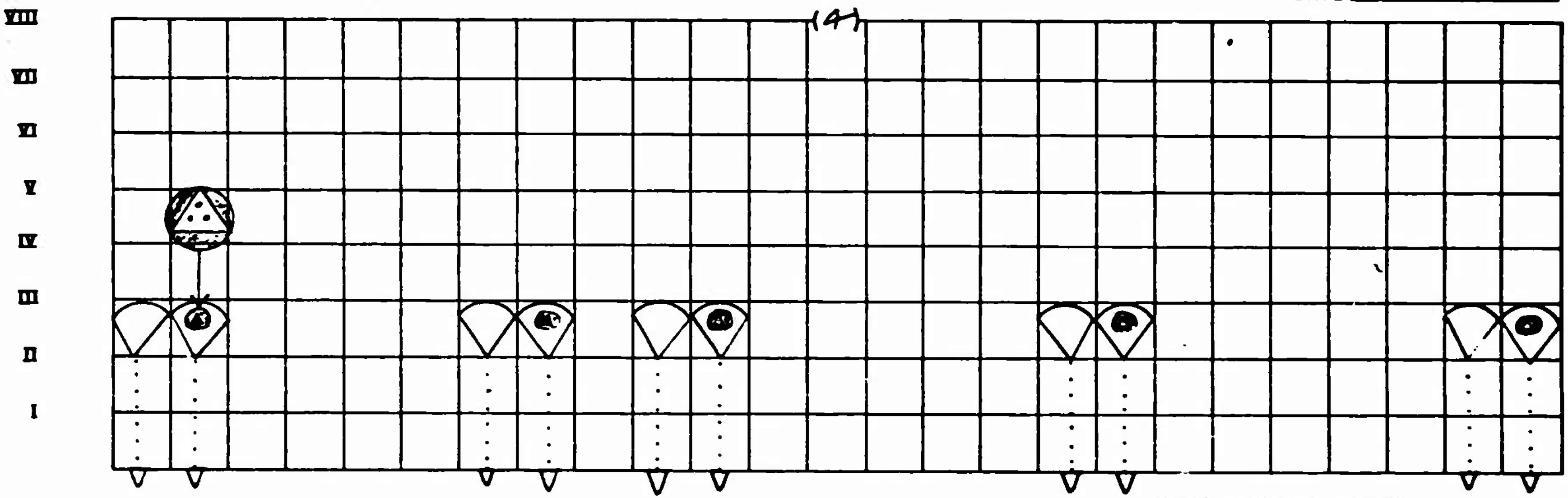

SAMPLE AREA DIAMETER



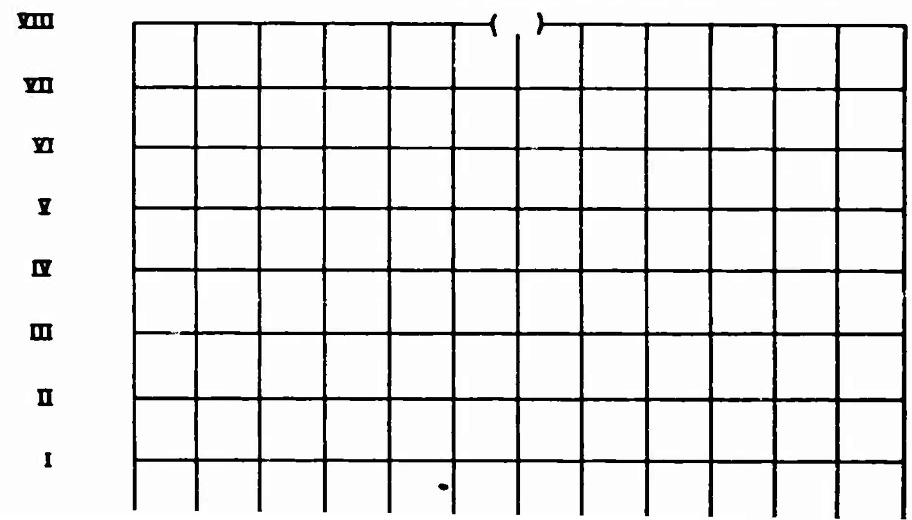

Incl 9

## VEGETATION STRUCTURAL DIAGRAM

LOCATION Site 14 DATE




SAMPLE AREA DIAMETER



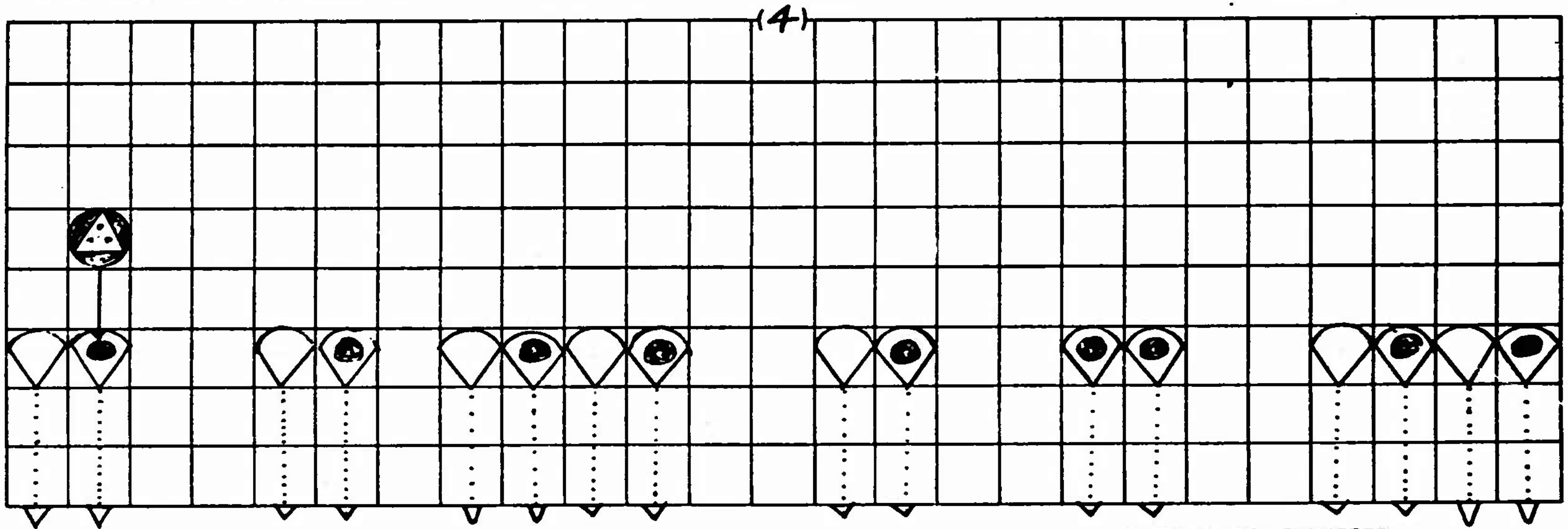
Incl 9

## VEGETATION STRUCTURAL DIAGRAM

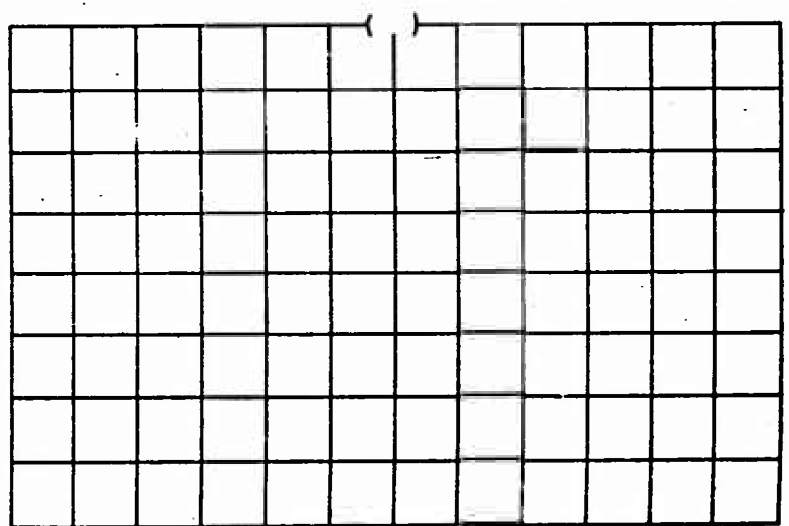
LOCATION Site 19

DATE

(4)



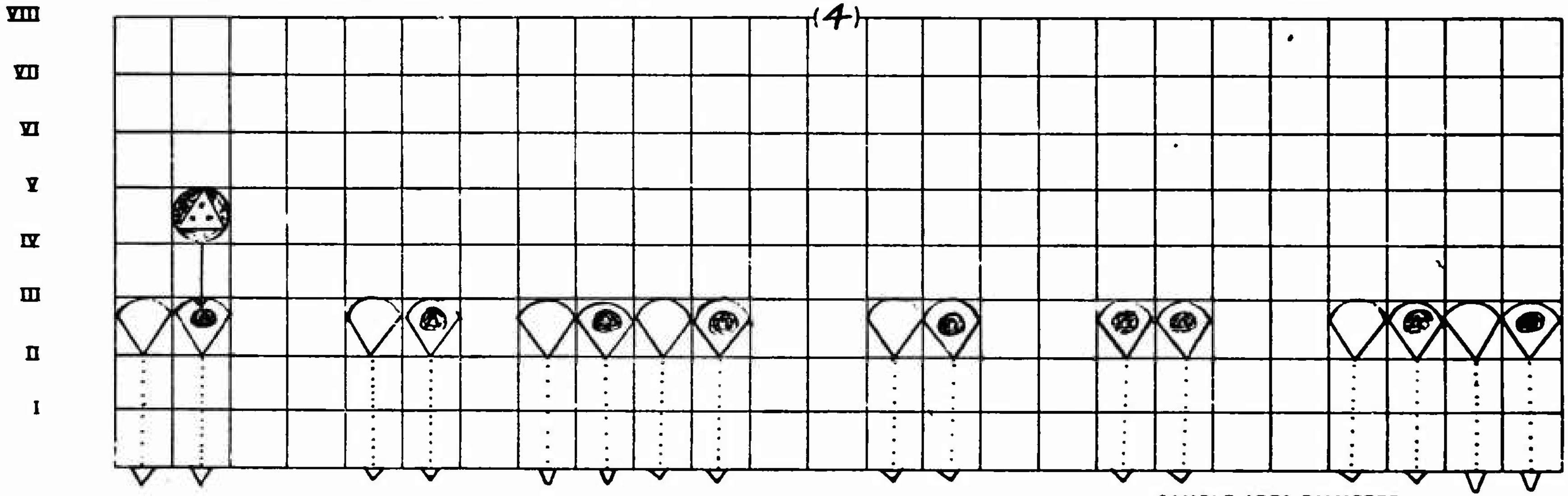

SAMPLE AREA DIAMETER



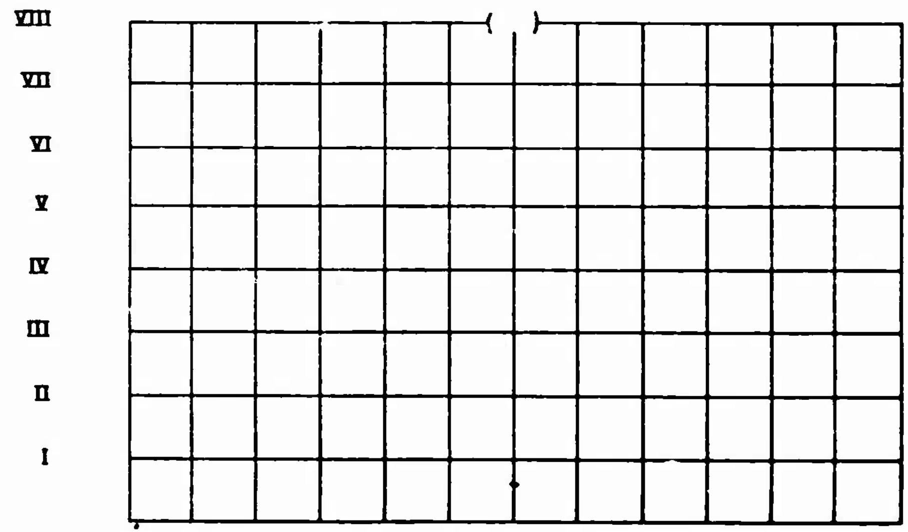
## VEGETATION STRUCTURAL DIAGRAM

LOCATION Site 20 DATE

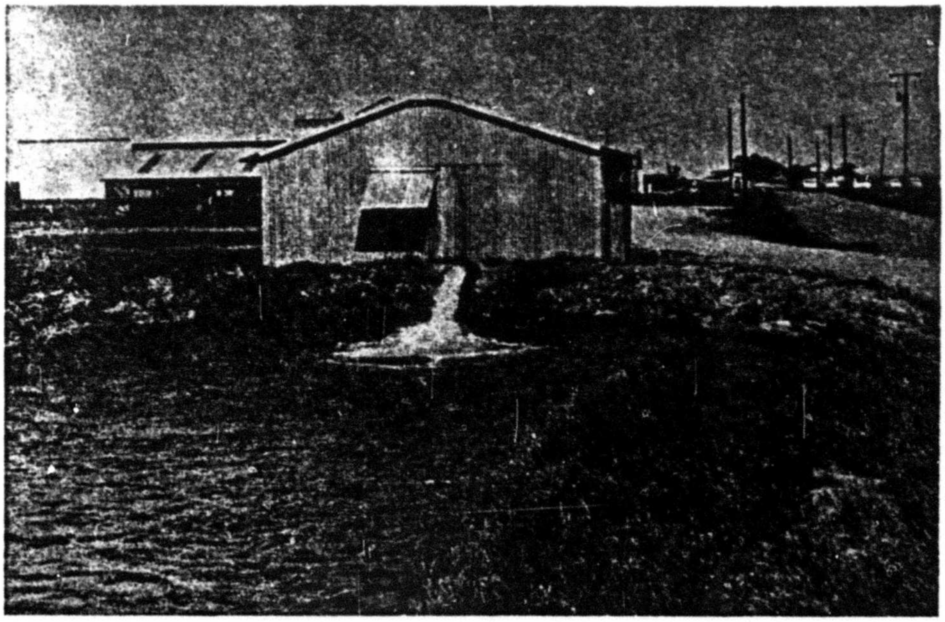
(4)




SAMPLE AREA DIAMETER




Incl



Typical irrigation canal and well,
Rice Experiment Station
Crowley, La.